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**THE IMPACT OF PTSD AND HISTORY OF INVOLVEMENT IN THE
CRIMINAL JUSTICE SYSTEM ON MEDICATION TREATMENT SUCCESS IN
OPIOID USE DISORDER**

A Dissertation Presented

By

KIRK SANGER

Submitted to the Graduate School of the
University of Massachusetts Amherst in partial fulfillment
of the requirements for the degree of

DOCTOR OF PHILOSOPHY

February 2019

College of Nursing

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**THE IMPACT OF PTSD AND HISTORY OF INVOLVEMENT IN THE
CRIMINAL JUSTICE SYSTEM ON MEDICATION TREATMENT SUCCESS IN
OPIOID USE DISORDER**

A Dissertation Presented

By

KIRK SANGER

Approved as to style and content by:

Lisa Chiodo, Chair

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College of Nursing

DEDICATION

I would first like to dedicate this work to those who find themselves struggling with a substance use disorder. Additionally, I dedicate this work to my family and friends who have helped me in immeasurable ways throughout this process.

ACKNOWLEDGEMENTS

I would like to begin by acknowledging the College of Nursing at the University of Massachusetts Amherst for the opportunity to first become a nurse through the second degree program and then continue on as a doctoral student.

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time, energy, and patience that Dr. Chiodo shared with me will not be forgotten and I only hope I can emulate that model with my own students. Working with Dr. Chiodo throughout the dissertation phase is certainly the highlight of my graduate career.

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ABSTRACT

THE IMPACT OF PTSD AND HISTORY OF INVOLVEMENT IN THE CRIMINAL JUSTICE SYSTEM ON MEDICATION TREATMENT SUCCESS IN OPIOID USE DISORDER

FEBRUARY 2019

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This analysis examined the impact of post-traumatic stress disorder (PTSD), history of trauma, and a history of involvement in the criminal justice system (CJS) on treatment outcomes related to medication treatment for opioid use disorder. This study employed a secondary analysis of data derived from a multi-state, multi-site treatment center focused on substance abuse and more specifically opioid use disorder treatment. The total sample size was 19,970 patients. The majority of the sample received treatment in Massachusetts, was white, and non-Hispanic. Those with PTSD accounted for 9.5% of the sample, while 12% had a history of trauma. Just under 1/4th of the sample had a history of involvement in the criminal justice system. All individuals in the sample were treated with buprenorphine and were expected to participate in both individual and group meetings related to their treatment.

Patients with a history of PTSD and trauma were more adherent with buprenorphine, but also more likely to use opioids than those without PTSD or trauma. Those with CJS involvement were more medication adherent and less likely to use opioids than those without a CJS involvement. All three risk groups were found to have

significant difficulty meeting other treatment visit compliance measures such as attendance to individual and group visits, had overall higher rates of total number of encounters, and were more likely to cancel their visits. PTSD and trauma moderated the relationship between CJS history and medication adherence and CJS history and opioid use. PTSD and trauma moderated the relationship between CJS history and other compliance indicators (e.g., number of initial visits and number of induction visits). Gender also moderated some of the relationships examined with women having more no-show visits, rescheduled visits more often and had higher rates of overall number of encounters. Women in particular failed to attend scheduled individual and group treatment sessions and spent more time in care. Women also had higher rates of PTSD and trauma.

The results have implications for clinicians caring for patients with OUD and patients with a history of incarceration. Assessing for and acknowledging trauma will allow those clinicians to implement patient-centered, trauma informed treatment models to deliver focused care to these specific populations that are struggling to meet treatment compliance measures.

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CHAPTER 1

OPIOID USE DISORDER, POST-TRAUMATIC STRESS, AND INVOLVEMENT IN THE CRIMINAL JUSTICE SYSTEM

Introduction

In America, 20.5 million people over the age of 12 have a Substance Use Disorder (SUD) (Center for Behavioral Health Statistics and Quality, 2016). Of those, over 2.1 million people have an opioid use disorder (OUD), while over 545,000 people have a dependency to heroin in the U.S. (NIDA, 2015). In 2016, approximately 948,000 people had at a minimum tried heroin, while it was estimated that 11.8 million people had misused a pain reliever, most of which were opioid based (Substance Abuse and Mental Health Services Administration, 2017).

Opioid addiction can lead to death, criminality, numerous co-morbidities, re-incarceration for previously incarcerated individuals, increased exposure to HIV and hepatitis C, and neonatal abstinence syndrome for newborns (NIDA, 2015).

Post-Traumatic Stress (PTS) and addiction typically co-occur (Danovitch, 2016; Hildebrand, Behrendt, & Hoyer, 2015). Co-occurring PTS further exacerbates an existing problem for those with and OUD and leads to reduced treatment outcomes (Meier et al., 2014). Of those 20.5 million with an SUD, approximately 1.4 million are currently incarcerated individuals (Fox, 2015). Of those prisoners, approximately 40% report having Post-Traumatic Stress (Flatt, Williams, Barnes, Goldenson, & Ahalt, 2016). Those who were already exposed to trauma before incarceration also show increase of trauma symptoms while incarcerated (Schappell, Docherty, & Boxer, 2016). PTS itself is a risk factor for increased incarceration. Having PTS increases the odds of being arrested, jailed, imprisoned, and having experienced at least four or more incidents of trauma (Jäggi, Mezuk, Watkins, & Jackson, 2016).

Understanding the relationships between opioid addiction, post-traumatic stress, and having a history of incarceration is imperative to successfully treating individuals that are struggling with addiction and are participating in medication treatment (MT).

Background of the Problem

Opioid Use Disorder

In the years from 1999-2015, the United States witnessed a four-fold increase in both the overdose deaths from opioids and heroin with a total of 33,091 deaths (O'Donnell, Gladden, & Seth, 2017). Opioid related deaths now account for the largest number of accidental deaths in the United States. While methadone related deaths since 2008 have decreased, there has been an increase in deaths related to heroin, illicitly manufactured Fentanyl, and abuse of other synthetic opioids (Rudd, Seth, David, & Scholl, 2016). An increase in the prescribing of opioids over the past 15-20 years has contributed to increasing rates of addiction and mortality due to nonmedical use of prescription opioids. There is also strong evidence that the nonmedical use of prescription opioids is often followed by the use of heroin (Compton, Jones, & Baldwin, 2016).

As of 2013, taking into account health insurance costs, loss of life and thus productivity, substance abuse treatment, and criminal justice costs, researchers at the Centers for Disease Control (CDC) estimate the U.S. economic burden to be approximately \$78.5 billion (Florence, Zhou, Luo, & Xu, 2016). We can only assume that as the opioid mortality rate continues to increase, so will this estimate.

OUD and Post-Traumatic Stress

Trauma is more often an antecedent to the use of opioids (Hassan, Foll, Imtiaz, & Rehm, 2017). Survivors of trauma, looking for a way to cope, use opioids or other drugs

and alcohol to self-medicate (Henwood & Padgett, 2007). Co-occurring Post-Traumatic Stress Disorder (PTSD) results in poorer treatment outcomes than for patients without symptoms of PTSD (Meier et al., 2014). More problematic is the reciprocal relationship between withdrawing from opioids and an increased stress response. Those with an OUD, often use opioids in response to increased stress. While those withdrawing from opioids can experience large amounts of stress. Therefore, refraining from opioid use while withdrawing can be extremely challenging and stressful. This can often lead to increased use (Danovitch, 2016; Hassan et al., 2017).

Gender Differences in OUD and PTS

Women are at a greater risk of experiencing trauma through sexual violence, emotional and physical abuse, and experiencing trauma at younger age. There are marked gender differences within OUD both for patients with and without PTS. PTS also has a role in partially mediating the relationship of women's substance use with violent offending (Howard, Karatzias, Power, & Mahoney, 2017). As women with PTS continue to use substances and commit violence, they are as a consequence, more likely to have a history of incarceration (Komarovskaya, Booker Loper, Warren, & Jackson, 2011). Women are more likely to be diagnosed with post-traumatic stress, substance abuse, and depression (Al-Rousan, Rubenstein, Sieleni, Deol, & Wallace, 2017).

While there has been variation in outcomes for those in concurrent treatment for SUD and PTS, there have been significant improvements for those receiving trauma focused dual treatment with attrition rates being the same across all groups (Killeen, Back, & Brady, 2015). Clinicians agree that there is a need for concurrent treatment, however are not in agreement as to how treatment should progress, especially in cases of severe trauma. The concern is notably whether or not the person re-experiences trauma

during therapy and thus desires to re-abuse substances to relieve said trauma (L. M. Najavits, Kivlahan, & Kosten, 2011).

Persons with Involvement in the Criminal Justice System and PTSD

While 18% of the overall incarcerated population will present with some mental health diagnosis (Al-Rousan et al., 2017), incarceration itself has implications to expose inmates to trauma while incarcerated (Beck, Berzofsky, Caspar, & Krebs, 2013). People who have been incarcerated or are presently incarcerated often feel unsafe, exhibit increased anti-social behavior, and symptoms of trauma due to circumstances related to but not limited to childhood trauma, domestic violence, and military violence pre-incarceration (Schappell et al., 2016).

OUD and Involvement in the Criminal Justice System

Entering the penal system in the United States while suffering with an OUD presents one of several situations and depends whether that person is incarcerated in a federal prison or a state run correctional facility. Not providing an MT at the beginning of incarceration has long-term implications for increased mortality and suicidality in the first few weeks of the incarceration experience (Larney et al., 2014; Rivlin, Ferris, Marzano, Fazel, & Hawton, 2013).

Federal Prison

Following a framework of abstinence from opioids, the United States Bureau of Prisons (BOP) directs clinicians within the federal prison system on a prescribed method for detoxification of inmates who present with a current SUD (Federal Bureau of Prisons, 2014).

Methadone is the recommended course of treatment until the cessation of withdrawal symptoms, followed by a 10% taper daily until the Methadone is

discontinued. Typically, adjunct treatment is included only for withdrawal symptoms in the form of Clonidine, as well as anti-inflammatories, antipyretics, anti-emetics, and anti-anxiety medication, but not a long-term opioid medical maintenance treatment. This will at times allow for a controlled withdrawal and symptom management, however does not assist long-term recovery during their incarceration or after re-entry.

State Correctional Facilities

Each state has their own policy regarding the use of MT within the correctional system. Depending on the particular state, some correctional facilities provide MT, while others do not (Aronowitz & Laurent, 2016). Treatment with continued opioid maintenance agonists such as methadone, or antagonists such naltrexone or a mix of the two, buprenorphine, is still not prevalent within the U.S. correctional system even though these methods are effective evidence-based medical practices. There are few instances where jails or prisons are providing viable treatments for incarcerated populations with an OUD. Treating inmates during their incarceration has lasting effects during the incarceration experience as well as post-release (Rich et al. 2015).

Persons with Involvement in the CJS and Medication Treatment

Exiting the correctional system with an OUD significantly puts individuals at higher risk for increased medical issues and re-incarceration, but also death (Binswanger et al., 2016; Marsden et al., 2017; Merrill et al., 2010). The risk appears to be heightened for younger people, women more specifically. In a study of 42,015 recently released individuals, 14,920 of which were young prisoners (<25yr), Van Dooren, Kinner, & Forsyth (2013) determined that the younger group was less at risk for mortality than older, previously incarcerated individuals. However, poisoning by drugs was the leading cause of death for the younger group with men at 43% and women 50%. More

specifically, the younger group, when compared to peers in their community at similar ages, were six times as likely to die. The women in the younger group were 20 times as likely to die than their community peers.

Studies are limited examining the outcomes of MT among incarcerated individuals. There are some however that demonstrate the effectiveness of MT both in the correctional setting and upon re-entering the community. These studies have demonstrated positive results in terms of overall health, reduction in mortality, and reduction in re-offending post-release (Degenhardt et al., 2014; Gisev et al., 2015; Larney, Toson, Burns, & Dolan, 2012; Marsden et al., 2017). While MT has been shown to be successful as a treatment modality for incarcerated prisoners evidenced by a lower recidivism rate, a decrease in cravings for opioids, and lower rates of sexually transmitted infections (Aronowitz & Laurent, 2016).

It is clear from previous research that MT is successful for some groups. However, when considering the effects of PTSD, trauma, and an involvement in the criminal justice system, it becomes clear that there is not a complete understanding of what those effects mean for those that have an OUD while also living with PTSD, a history of trauma, or a past involvement in the criminal justice system. Understanding these relationships may allow practitioners that ability to deliver more applicable treatment to these groups.

Significance of the Study

Opioid addiction can lead to death, criminality, numerous co-morbidities, re-incarceration for previously incarcerated individuals, increased exposure to HIV and hepatitis C, and neonatal abstinence syndrome for newborns (NIDA, 2015).

Approximately 30% of the people in seeking treatment for their opioid addiction have a

diagnosis of PTSD (Ecker, Hundt, Ecker, & Hundt, 2017). Additionally, 50% of those people seeking treatment for OUD have an involvement in the criminal justice system (Winkelman et al., 2016) and 80% have a diagnosis related to an anxiety disorder (Brady, Haynes, & Killeen, 2013).

MT has demonstrated success among those in treatment in the form of agonist and antagonist therapy for long-term recovery (Hser, Evans, Grella, Ling, & Anglin, 2015b). This approach to MT is often combined with individual or group counseling techniques aimed at allowing the patient to change their neurobiology as well as their cognitive relationship to opiates. At times this has increased retention within combined treatment programs (Timko, Schultz, Cucciare, Vittorio, & Garrison-Diehn, 2016). However, this may actually inhibit successful treatment of PTSD as this may interrupt the development of coping skills (Danovitch, 2016; Saunders et al., 2015a). Understanding these relationships more clearly will enable clinicians to intervene more appropriately when presented with someone with co-occurring PTSD and participating in MT.

Understanding how these interactions affect those with involvement in the criminal justice system who are in the process of recovery will aid in long term success.

Developing a clearer understanding and framework for treatment within this smaller subset of the population may allow clinicians to treat other groups of individuals suffering from the combination of PTSD and OUD. Veterans, sexual abuse survivors, refugees, or other individuals living with PTSD and OUD will benefit from the approaches and practices that can be instituted with the knowledge from this proposed study.

Purpose

The purpose of this study is to explore the relationships between Opioid Use Disorder, Post-Traumatic Stress, involvement in the criminal justice system, and MT treatment success.

Study Aims and Hypotheses

To achieve the study goal, this proposal will examine the following aims and hypotheses in a sample of Opioid Use Disorder patients receiving MT. For all aims, the following outcome variables will be examined: treatment compliance (the number no show visits, number maintenance visits, number of initial visits, number of rejoin visits, number of induction visits, number of group visits, number of no show group visits, number of group cancellations, number of rescheduled visits, number of interruptions, number of other encounters, total time in care, and the time since the last visit), medication adherence, and drug use (opioids, cocaine, THC, methadone, benzodiazepines, alcohol, amphetamines, cocaine, other drugs. Other drugs included PCP, barbiturates, methamphetamines, and ecstasy.

Aim 1: To compare outcomes of Medication treatment (MT) success in patients with elevated post-traumatic stress (PTS) and patients without PTS.

H1a-m. Patients with evidence of PTS will have lower rates of treatment compliance than patients without evidence of PTS.



H1n. Patients with evidence of PTS will have a lower rates of medication adherence compared to patients without evidence of PTS.



H1o. Patients with evidence of PTS will have an increase in drug use than patients without evidence of PTS.



Aim 2: To compare outcomes of Medication treatment (MT) success in patients with a history of trauma (Trauma+) and patients without a history of trauma.

H2a-m. Patients with evidence of Trauma will have lower rates of treatment compliance than patients without evidence of Trauma.



H2n. Patients with evidence of Trauma will have a lower rates of medication adherence compared to patients without evidence of Trauma.



H2o. Patients

with evidence of Trauma will have an increase in drug use than patients without evidence of Trauma.



Aim 3: To compare outcomes of Medication treatment (MT) success in patients with a history of involvement with the criminal justice system (CJS) and patients without a history of involvement in CJS.

H3a-m. Patients with involvement in the criminal justice system will have lower rates of treatment compliance than patients without involvement in the criminal justice system.



H3n. Patients with involvement in the criminal justice system will have lower rates of medication adherence compared to patients without involvement in the criminal justice system.

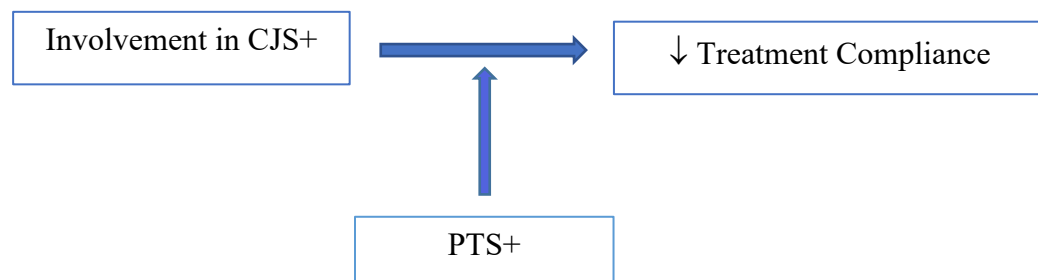


H3o. Patients with an involvement in CJS will have an increase in drug use than patients without involvement in the criminal justice system.

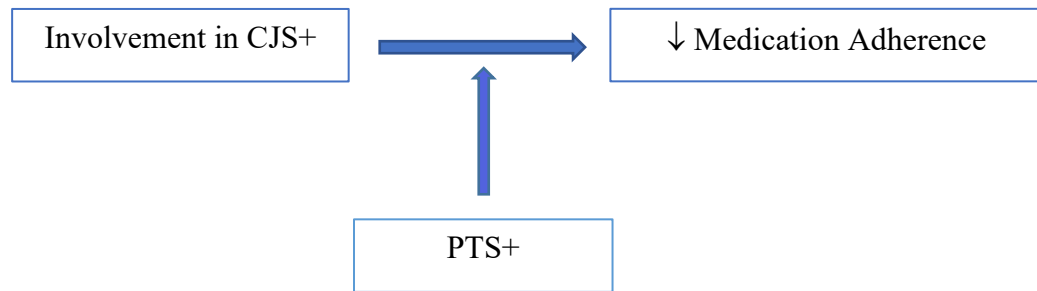


Aim 4. To examine if PTS status moderates the relationship between involvement in the criminal justice system and Medication Treatment success.

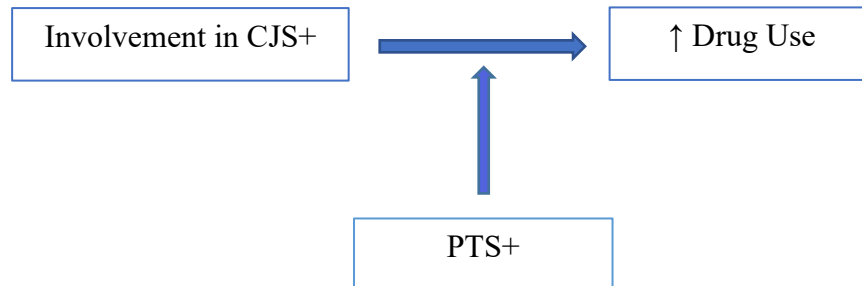
H5a-m. The relationship between involvement in the criminal justice system and provider visit compliance will be moderated by PTS status.



H5n. The relationship between involvement in the criminal justice system and medication adherence will be moderated by PTS status.

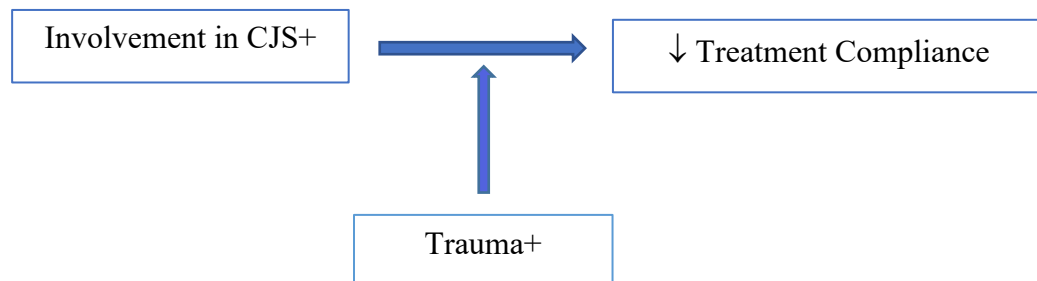


H5o. The relationship between involvement in the criminal justice system and drug use will not be moderated by PTS status.

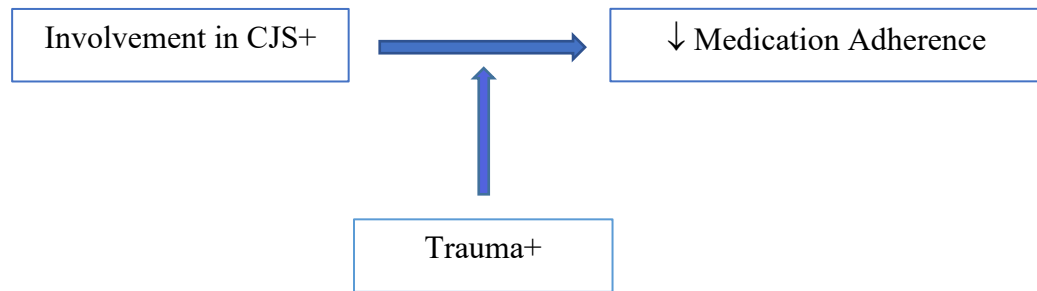


Aim 5. To examine if trauma status moderates the relationship between involvement in the criminal justice system and Medication Treatment success.

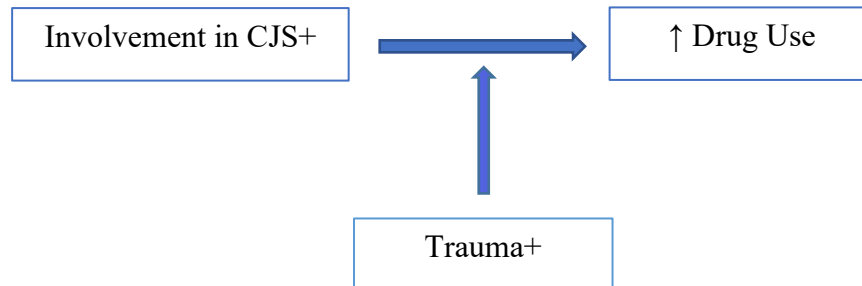
H6a-m. The relationship between involvement in the criminal justice system and treatment compliance will be moderated by trauma status.



H6n. The relationship between involvement in the criminal justice system and medication adherence will be moderated by trauma status.



H6o. The relationship between involvement in the criminal justice system and drug use will not be moderated by trauma status.



In addition to the above aim, the influence of gender on the impact of PTS+ or trauma on the relationship between buprenorphine and treatment success was examined.

Summary

Given the substantial personal and societal impact of opioid use, understanding factors that might impact MT treatment is critical. Understanding if factors such as PTS and CJS status will lead to poorer OUD treatment success provides an opportunity for the development of interventions to increase treatment retention and success for all individuals with OUD. In addition, understanding the relationship of PTS, CJS and MT treatment will allow clinicians the opportunity to provide evidence-based treatment to a very deserving population.

CHAPTER 2

REVIEW OF LITERATURE AND THEORETICAL FRAMEWORK

This chapter provides an overview of the complexities of opioid use disorder (OUD), co-occurring post-traumatic stress (PTS), and having a history of incarceration. This is a review of the literature as it pertains to the relationships of OUD, post-traumatic stress, incarceration, and medical management of OUD. I utilize a theoretical framework developed by Lazarus and Folkman – the Transactional Stress theory as it relates to treatment of opioid use disorder with having co-occurring post-traumatic stress, trauma, and an involvement in the criminal justice system.

Introduction

In America, 20.5 million people over the age of 12 have a Substance Use Disorder (SUD) (Center for Behavioral Health Statistics and Quality, 2016). Of those, over 2.1 million people had an opioid use disorder (OUD), while over 545,000 people are dependent on heroin in the U.S. (NIDA, 2015). Opioid addiction can lead to death, criminality, numerous co-morbidities, re-incarceration for previously incarcerated individuals, increased exposure to HIV and hepatitis C, and neonatal abstinence syndrome for newborns (NIDA, 2015). In 2016, approximately 948,000 people had at a minimum tried heroin, while it was estimated that 11.8 million people had misused a pain reliever, most of which were opioid based (Substance Abuse and Mental Health Services Administration, 2017).

Post-Traumatic Stress (PTS) and addiction typically co-occur (Danovitch, 2016; Hildebrand et al., 2015). Co-occurring PTS further exacerbates an existing problem for those with and OUD and leads to reduced treatment outcomes (Meier et al., 2014). Of those 20.5 million with a SUD, approximately 1.4 million are currently incarcerated

individuals (Fox, 2015). Of those prisoners, approximately 40% report having Post-Traumatic Stress (Flatt et al., 2016). Those who were already exposed to trauma before incarceration also show an increase of trauma symptoms while incarcerated (Schappell et al., 2016). PTS itself is a risk factor for increased incarceration. This is especially evident for black men. Having PTS increases the odds of being arrested, jailed, imprisoned, and having experienced at least four or more incidents of trauma (Jäggi et al., 2016).

Understanding the relationships between opioid addiction, post-traumatic stress, and having a history of incarceration is imperative to successfully treating individuals that are struggling with PTS, addiction and are receiving medication treatment (MT).

Background of the Problem – Opioid Use

Opioid use is not a new phenomenon. The medicinal origins of opioid use can be traced back as early as 1,500 B.C. (Brownstein, 1993). During antiquity, opium poppies used on statues and in paintings, represented sleep and death (Tekiner & Kosar, 2016). More formalized in the sixteenth-century, the social use of ‘laudanum’, a potent mix of opium (later replaced by morphine) and alcohol, was reserved for the social elite (Heyman, 2009). Physicians, as they do today, played a role in perpetuating the uses and efficacy of opiates for numerous ailments (Kulich & Loeser, 2011). These were at times reasonable and at other times bordered on the farfetched. These ailments included: pain, sleep, headaches, menstrual cramping, diarrhea, insanity, and even used to treat tuberculosis among other infective diseases (Postler & Waisel, 1997).

While opium was already widely used, it gained recognition as an addictive substance in the late eighteenth-century and was responsible for creating a schism in the trade economy between Britain and China. As Britain pushed more opium into China in

exchange for silver, more of the Chinese population became dependent on the substance. China became well aware of the physical and mental distress enacted on their citizens who had become overwhelmed by the substance causing conflict in what would go on to be known as the Opium Wars (Caquet, 2015).

This has continued to present day where the reasons people use and abuse opioids, be it prescription or illegal, are varied. Some come to opioid use as a way to relieve pain from surgery, cancer, or other physical ailments (Moryl et al., 2017; Yorkgitis & Brat, 2018). Of those, some come to abuse opioids as a way to supplement their pain management that they believe is not being properly controlled. For some, opioids are a natural progression from less potent drugs. Others use opiates as a recreational experience, merely trying it out due to sheer curiosity and to feel the sedating effects of the drug. As will be examined further, others use opiates for the relief of mental anguish and trauma (Stumbo et al., 2017).

Opioid Use Disorder

In the years from 1999-2015, the United States witnessed a four-fold increase in both the overdose deaths from opioids and heroin with a total of 33,091 deaths (Dowell, Arias, Kochanek, & al, 2017; O'Donnell et al., 2017). Opioid related deaths now account for the largest number of accidental deaths. While methadone related deaths since 2008 have decreased, there has been an increase in deaths related to heroin, illicitly manufactured Fentanyl, and abuse of other synthetic opioids (Rudd et al., 2016). An increase in the prescribing of opioids over the past 15-20 years has contributed to increasing rates of addiction and mortality due to nonmedical use of prescription opioids. There is also strong evidence that the nonmedical use of prescription opioids is often followed by the use of heroin (Compton et al., 2016).

As of 2013, taking into account health insurance costs, loss of life and thus productivity, substance abuse treatment, and criminal justice costs, researchers at the Centers for Disease Control (CDC) estimate the U.S. economic burden to be approximately \$78.5 billion (Florence et al., 2016). We can only assume that as the opioid mortality rate continues to increase, so will this estimate.

The Diagnostic and Statistical Manual of Mental Disorders fifth edition (5th ed.; DSM-5; American Psychiatric Association [APA], 2013)¹ describes Opioid Use Disorder (OUD) as a persistent, chronic, use of opioids that over the course of a 12-month period is characterized by at least two criteria (Appendix B).

Concurrent with the DSM-V criteria, the American Society of Addiction Medicine (ASAM) describes any addiction in terms of the chronic nature in which these occur. ASAM further views the brain and neural network as the chief contributor to addiction as the brain has the inherent capacity to influence motivation, reward, craving, and need to satisfy both physical and mental discomfort (American Society of Addiction Medicine, 2015).

Treatment Options in Opioid Use Disorder

Treatment for OUD presently exists in two major forms. These are abstinence-based models and models that include Medication Treatment (MT).

Abstinence Model of Opioid Treatment

Abstinence models are based solely on the idea that people will recover from opioid use without the assistance of opioid agonists or partial agonists. The colloquial term often used is that the person withdrew from opioids ‘going cold turkey’. If this course of treatment is decided upon, the ASAM recommends that some medication be

¹ *Diagnostic and Statistical Manual of Mental Disorders : DSM-5.* (2013) (see Appendix B)

used to treat withdrawal symptoms and that this is done in conjunction with personalized, psychosocial treatment. Abstinence based treatment is not the recommended treatment based on evidence-based practice and current research findings that using Medically Assisted Treatment is not only safer, but reduces relapse and mortality among other outcomes (American Society of Addiction Medicine, 2015; Bart, 2012).

Medication Treatment

Medication treatment (MT) is a course of treatment that began when those with an Opioid Use Disorder were first given medicine in the form of an opioid agonist to help prevent relapse and relieve the immense symptoms felt when withdrawing from opioids. This was first initiated with the use of morphine and decreasing doses of heroin to taper people off of opioids. Pharmaceutical oxycodone, codeine, and Demerol were also tried initially, but were disregarded as they tended to still have the sedating effect of short acting opioids and increased tolerance as their use continued. Methadone, which is the preferred treatment modality with the highest rates of opioid reductions, decreased mortality, and retention in treatment (Substance Abuse and Mental Health Services Administration, 2018) approved was then developed as a longer acting opioid that did not cause the euphoria of morphine and heroin, or increase the tolerance as earlier opioids had, yet still managed to decrease cravings and did not sedate patients as did earlier short acting opioids (Center for Substance Abuse Treatment, 2012).

Buprenorphine/Naloxone is a recent addition to the options that clinicians have in terms of treating people using an opioid maintenance treatment. This drug in particular has the benefit of seeking the same mu receptors as opioids, yet, does not have the same effect once it is in place as the naloxone aspect is an opioid antagonist and lowers the potential for the same euphoria and sedating effects of opioids (Center for Substance

Abuse Treatment, 2012). Buprenorphine has been shown to be a successful medicinal treatment for OUD in reducing cravings, relapse, and mortality (Ohtani, 2007).

Naltrexone has been available since the late 1960's but has only seen an increase in use as a once a month extended-release injectable. This particular form of MT is used as a non-agonist medicine that blocks opioid substances from entering mu receptor sites in the brain. The injectable is thus the preferred method of administration as this prevents the patient from having to remember to take their pill every day, has a greater half-life, allows for a greater reduction in cravings, is more expensive initially but then evens out over time, and relates to longer periods of recovery (Substance Abuse and Mental Health Services Administration, 2016).

While counseling is the preferred treatment concurrent with opioid substitution treatment, there are still mixed findings in terms of efficacy of counseling treatment. For instance, Fiellin et al. (2006) found that during a study of Buprenorphine distribution at single or multiple times per week, that when combined with short or long-term counseling, there were no differences between groups that suggested either counseling method had a significant effect on prevention of relapse. Fiellin et al. did note that the type of counseling was not prescribed and were not tailored to each individual patient.

Similarly, Weiss & Rao (2017) conducted a study that compared treatment for prescription opioid users who either received opioid drug counseling and those who did not. Their findings demonstrated that the counseling group was not more successful in treatment. However, they did note after further analysis of the counseling groups that those who had a history of heroin use were more successful in the combined counseling/Buprenorphine than those with a history of heroin use who were not in the combined group.

Conversely, Moore et al. (2016) found that Cognitive Behavioral Treatment (CBT) was a successful approach when combined with physician managed Buprenorphine treatment for those with prescription opioid use, but not for those who had used heroin.

Anxiety/OD

While PTS dominates the focus of today's psychiatric worldview, PTS is only one disorder grouped under the umbrella of Anxiety disorders which is grouped in the AXIS 1 domain of the DSM-V. The AXIS 1 delineation denotes that all disorders in this group are the most common psychiatric disorders in our culture (*DSM-5*, 2013).

An 2009 systematic review by Fatséas, Denis, Lavie, & Auriacombe (2010) using DSM-IV criteria revealed a lifetime prevalence of anxiety among those with an OD ranging from 26%-35%. Fatseas et al. (2010) note that of these studies, there are two major hypotheses for anxiety to present as a diagnosis. When an anxiety diagnosis emerges initially then is followed by a diagnosis of OD, often opioids or other substances are used to self-medicate to relieve the symptoms and feelings or anxiety. In the contrary sequence, OD emerges as the first diagnosis with anxiety following as the second diagnosis as a resultant symptom of being in opioid withdrawal through recovery.

Researchers investigating the prevalence of co-occurring psychiatric diagnoses among those with an initial OD diagnosis in Spain, found that anxiety was the highest co-occurring disorder (53%) (Roncero et al., 2016). Other research examining the consequences of anxiety on co-occurring diagnoses found that individuals with an anxiety disorder are more likely to seek out prescription opioids. In a study reviewing medical office prescriptions for Schedule II opioids from 1995-2010, those with an

anxiety disorder were 11 times more likely (OR=10.99) to use prescription opioids (Olfson, Wang, Iza, Crystal, & Blanco, 2013).

Treatment of Co-occurring Anxiety and OUD

Treating co-occurring anxiety and OUD medically presents problems for the clinician looking to quell both anxiety and OUD cravings as well as other symptoms. General treatment recommendations for anxiety is to try first-line medications that include serotonin reuptake inhibitors (SRI) first. These do not always work well in this population and it is therefore recommended to try benzodiazepines (BZD) as a second line medication. This approach is typically affective at decreasing symptoms. The problem is that BZDs are not recommended for use for people with SUDs, especially OUD (Craske & Bystritsky, 2017).

That recommendation appears to be followed by the majority of physicians. In a recent study of people using BZDs, only 27.8% of them received them from their physician (not all were in opioid treatment), while 51.3% bought them on the street and the remaining 20.9% took them from or were given them by a friend or family member. If those with an OUD are misusing and abusing BZDs as well, it is clear that it may not be under the care of a physician (Stein, Anderson, Kenney, & Bailey, 2017).

An earlier synthesis of 200 articles conducted by Jones, Mogali, & Comer (2012) found a multitude of complications resulting from concurrent use of both opioids and BZDs. They noted increased use of BZDs for heroin users entering treatment and up to 75% prevalence rate of using BZDs for those in opioid treatment using buprenorphine. This is supported by a recent study by Morley, Ferris, Winstock, & Lynskey (2017) examining misuse and abuse of prescription opioids. Utilizing the Global Use Survey, containing data from several nations, they held country of residence constant in their

model and were able to determine that those using illicit opioids as well as BZDs had an OR=6.49 of abusing their prescribed opioid analgesic.

One promising outlook is that the treatment for OUD may in fact decrease symptoms of anxiety. Ahmadi & Jahromi (2017) hypothesized that one dose of buprenorphine would decrease anxiety in opioid dependent patients. Here we can see that OUD was not even the focus, lessening anxiety was the aim. They found that regardless of dosage amount, using one dose of buprenorphine lessened anxiety significantly over a seven day period. This study did not address what place anxiety had within the realm of OUD. They were not asking whether or not anxiety was an antecedent to OUD, a consequence of OUD, or influenced the outcomes of treatment for OUD.

Post-Traumatic Stress

Post-Traumatic Stress (PTS) is the consequence of having experienced an overwhelming physical or emotional event or events that causes the body and mind to later react as though it were under the same stressors of the initial event or cumulative events. Both the trauma itself and the symptoms that follow from PTS are highly subjective. What one person perceives as a traumatic event, may not be the same for another person. Additionally, after experiencing the same event and being traumatized by it, people will react to it and exhibit different symptoms from one another. Symptoms can include but are not limited to: anxiety, social withdrawal, depression, avoidance of feelings, tremors, flashbacks, gastrointestinal disturbances, somatic pain and discomfort, etc. (Regel & Joseph, 2010).

Noted trauma psychiatrist and researcher, Bessel Van Der Kolk (2014), states that recovery for victims of trauma is difficult as the trauma itself often changes features

within the brain and specifically the pre-frontal cortex. This area of the brain is essential to making decisions needed to making decisions, plan, and make corrections in behavior.

Trauma Leading to PTSD

Not all traumatic experiences (TE) are created equal and not all who experience TEs have the same outcome. Experiencing at least one TE is actually a relatively common experience for people around the globe with one study showing up to 66.5% of participants meeting criteria for at least one TE in their lifetime (Elhai et al., 2012). Why some people then suffer from Post-Traumatic Stress (PTS) while others do not is a question that many are attempting to answer.

Noting a lack of definitive evidence for predictability of PTSD following TE, a group of international scholars has developed one promising method aimed at determining predictors of Post-Traumatic Stress Disorder (PTSD) among those who have had a TE. The researchers utilized data from the World Health Organization's (WHO) World Health Survey. Of the 126,096 respondents, 42,634 reported at least one TE over their lifetime. Exploratory factor analysis narrowed the 29 subtypes of TEs down to 5 factors: "exposure to organized violence, participation in organized violence, interpersonal violence, sexual-relationship violence, and other life-threatening TEs" (Kessler et al., 2014, p. 267).

Applying regression modeling and machine learning algorithms allowed the group to predict that the highest risk for developing PTSD was a TE involving sexual-relationship violence. This type of TE accounted for 12.1% of the overall TEs in the population but accounted for 32.9% of the overall proportion of PTSD among the group. The 2nd highest sub-group was a sixth category named Network Traumatic Experiences which included: unexpected death of a loved one, life-threatening illness of child, other

traumatic experience of loved one. This accounted for 22.5% of all TEs and 29.7% of the proportion of PTSD (Kessler et al., 2014). What is striking is that participating in organized violence such as combat, purposely/accidentally caused a death, witnessed death, etc., accounted for 21.3% of the TEs, yet only 11.2% of the proportion of PTSD. As expected from previous studies, Kessler et al. (2014) also determined that TE was related to an increased risk of a psychiatric diagnoses; individuals with TE were 27 times more likely to have a PTSD diagnosis and just over two times more likely to have a diagnosis of generalized anxiety disorder.

For those with prior or current psychiatric diagnoses and a TE, PTSD is more predictable (Powers et al., 2014). While examining predictability of PTSD for patients admitted to a level I trauma center, they were able to predict PTSD with 76.3% accuracy at 3-month follow-up. Powers et al. (2014) found their predictors to be age (younger), gunshot wounds, and number of premorbid psychiatric conditions. Two critiques of this study is that they were focused solely on physical injury and negated sexual violence as a physical injury and thus it was not included in their model. Additionally, during their screening process, 12% of participants tested positive for drugs and were also given the AUDIT-C as an alcohol screening. The drugs finding was not included in their model. Though they included alcohol and found it to be not predictive of PTSD. However, the inclusion of premorbid psychiatric conditions continues to represent a major predictor for each study reviewed.

Furthermore, Carlson, Palmieri, & Spain (2017) working on the predictability of PTSD as well, found another set of risk factors following trauma to be predictive of PTSD. These were negative thoughts, post-trauma life stress, post-trauma social constraints, post-trauma social support, acute stress symptoms, and childhood home life.

When these risk factors were subjected to sensitivity and specificity analysis, they found a high sensitivity or the probability that the risk factors are present in those that have PTSD (0.85 - 0.97). The specificity or the probability that risk factors were not present in the people that did not have PTSD was also acceptable (0.68 – 0.83) (Rosner, 2015).

From Trauma Experience to PTSD Diagnosis

While research is promising in terms of how TEs contribute to PTSD, the importance should be placed on how clinicians are utilizing the aforementioned research in identifying risk factors, screening, and then diagnosing properly. Liebschutz et al. (2007) conducted a study at an urban primary care office screening 509 patients for TEs, PTSD, and psychiatric comorbidities and then compared those findings to the electronic medical record (EMR) for each participant for diagnostic comparison. Consistent with Elhai et al. (2012) they found that 79% of the participants had at least one TE and 65% had more than one TE. They determined that 39% met the DSM-IV criteria for lifetime PTSD and 23% met the criteria for current PTSD. Consistent with previous studies (Carlson et al., 2017; Olaya et al., 2015; Powers et al., 2014) was the finding that 91% of those with PTSD had at least one co-morbidity.

Of these participants, 64% of those with anxiety, had a lifetime PTSD diagnosis, 42% had a current diagnosis of PTSD. Those with substance use had a lifetime PTSD prevalence of 52%. The most alarming finding of the study is that when comparing these findings to the participant's EMR, they found that only 11% of those with PTSD had a congruent diagnosis reflected in their EMR. In a recent review (Greene, Neria, & Gross, 2016) of studies examining the prevalence of PTSD in primary care settings, prevalence rates in studies ranged from 2 - 27% and detection rates from 2.4 – 46.5% when comparing study diagnosis with EMR similar to Liebschutz et al. (2007).

Opioid Use Disorder and Post-Traumatic Stress

Survivors of trauma, looking for a way to cope, use opioids or other drugs and alcohol to self-medicate (Hser, Evans, Grella, Ling, & Anglin, 2015a). However, Henwood & Padgett (2007) remind readers that the purely self-medication hypothesis is one that should be viewed as suspect and may include multiple risk factors and co-morbidities. Trauma is often an antecedent to the use of opioids. Utilizing data from the National Epidemiologic Survey on Alcohol and Related Conditions III, Hassan, Foll, Imtiaz, & Rehm (2017) demonstrated that individuals with a PTS diagnosis earlier in life were three times as likely to develop an OUD compared to those who had an OUD but were never diagnosed with PTS. Controlling for age, education, marital status, living area, self-reported general health, and employment status still resulted in a 65% increase in risk.

One of the reasons PTS is detrimental to those with an OUD is the increased capacity for misuse of the opioids they receive. Cochran, Hruschak, Bacci, Hohmeier, & Tarter (2017) performed latent class analysis on data from 333 people in community pharmacies specifically looking for subgroups that may be more predisposed to using prescription opioids improperly. One subgroup identified was a group of individuals with co-occurring PTS, depression, and report of pain in the past four weeks. Among this group, 44% had misused their prescription opioids and were six times more likely to do so than other groups identified.

Symptoms of PTS with OUD

Even the degree to which symptoms of PTS are experienced are affected by having a co-occurring OUD. Meier et al. (2014) found that the symptoms of PTS were influenced by overall substance use and even more by opioid use. Of their sample of 573

subjects, they found that of the 218 people using prescription opioids, 47% met the diagnostic criteria for PTS. They were also able to determine that symptom severity increased with polysubstance abuse and increased depending on substances.

Increased PTS symptom severity and increased substance use disorder (SUD) was also demonstrated in an much earlier study conducted by Brown, Stout, & Gannon-Rowley (1998) on the perception of the relationship of a person's own substance use disorder (SUD) and their co-occurring PTS or trauma symptoms. They determined that people with co-occurring SUD/PTS tended to view these two disorders as related to one another. Though a small sample, 77% of their participants felt that when their trauma symptoms worsened, there was a direct impact on their substance use. Similarly, 78% responded that if their trauma symptoms resolved or improved, so did their substance use.

Treatment of OUD with Co-occurring PTS

Treatment of opioid use disorder (OUD) while co-occurring with PTS is complicated and may require multiple frameworks. Beyond the reasons for why one uses opioids, or the inherent diversity in the demographics of people who use opioids, Killeen, Back, & Brady (2015) provide a review of the mix of obstacles that impacts treatment of both PTS/OUD together and individually. One key barrier to treatment is that at times there is a lack of commitment to treat both OUD and PTS equally or concurrently. This is compounded often by an organization's misunderstanding of a particular paradigm and lack of a method to ensure fidelity to the prescribed treatment of concurrent OUD/PTS. In some parts of the country, counselor turnover is high due to a perceived stigma of treating patients with SUD while simultaneously valuing the treatment of those with PTS. Just these issues alone make it difficult to provide a sustained, evidence-based treatment.

Thus, co-occurring Post-Traumatic Stress Disorder (PTS) can result in reduced treatment outcomes than for patients without symptoms of PTS (Meier et al., 2014).

However, there have been instances where sustained OUD/PTS treatment has been shown to be effective. Tofighi et al. (2015) found that due to early treatment evaluations at admission to a buprenorphine clinic, they were able to treat PTS concurrently with OUD. They evaluated treatment outcomes for subjects who were in concurrent OUD treatment and were participating in psychiatric treatment for their PTS both pre and post Hurricane Sandy. They noted that although subjects missed follow-up appointments and missed opportunities to acquire their buprenorphine, at 6-months post Hurricane Sandy, this particular group showed no increase in positive drug screens.

Peirce, Brooner, King, & Kidorf (2016) evaluated subjects who had an alarming average of 18 lifetime traumatic events. They found that when subjects had a traumatic event during treatment, this doubled their risk of non-compliance with treatment in the month following the event. Even more profound was in the months after the initial month, this risk doubled again.

Stress Response in OUD/PTSD

The reciprocal relationship between withdrawing from opioids and an increased stress response is problematic for those with OUD. While withdrawing from opioids increases stress, the converse is also true that those with OUD use opioids to reduce stress. Constantinou et al. (2010) compared the stress levels and attentional bias of users of heroin against ex-users and non-users. The current users of heroin demonstrated not only a significantly higher level of stress during the study than ex-users and non-users, but also had significantly higher levels of drug craving during the study. An additional finding of the study was that the current user group had a significantly higher level of

attentional bias during short and long-term exposure to toward heroin related subject matter utilized during the study. They posit that stress potentially leads to more attentional bias and craving in users which directly relates to an inability to resist and remain abstinent. This is reflective of Lazarus & Folkman's (1984) concept of appraisal within stress and coping. As a current user is appraising a stressful situation or event, if attentional bias is focused on the use of an opioid, this attention limits the ability to cope and reduce stress, thus leading potentially to the use of an opiate.

Withdrawing from opioids can cause large amounts of stress. Therefore, refraining from opioid use while withdrawing can be extremely challenging and stressful. This can often lead to increased use (Danovitch, 2016; Hassan et al., 2017).

Demographic Differences in Treatment of OUD/PTS

Gender

It should be noted that women are at greater risk of experiencing trauma through sexual violence, emotional and physical abuse, and at younger age. There are marked gender differences within OUD both for patients with and without PTS. PTS also has a role in partially mediating the relationship of women's substance use with violent offending (Howard et al., 2017). As women with PTS continue to use substances and commit violence, they are as a consequence, more likely to have a history of incarceration (Komarovskaya et al., 2011). In a study of 573 adult subjects, Meier et al. (2014) demonstrated that women who have PTS and OUD not only experience almost three times the severity of PTS symptoms as men, but also 30.1% of the women in the sample compared to 18% of the men had co-occurring PTS and OUD.

While there has been variation in outcomes for those in concurrent treatment for SUD and PTS, there has been significant improvements for those receiving trauma

focused dual treatment with attrition rates being the same across all groups (Killeen et al., 2015). Clinicians agree that there is a need for concurrent treatment, however are not in agreement as to how treatment should progress, especially in cases of severe trauma. The concern is notably whether or not the person re-experiences trauma during treatment and thus desires to re-abuse substances to relieve said trauma (L. M. Najavits et al., 2011).

ODU among Persons with an Involvement in the CJS

Having an involvement in the Criminal Justice System (CJS) has the potential to increase the risk of traumatic experiences and thus PTS (Anderson, Geier, & Cahill, 2016; Harner, Budescu, Gillihan, Riley, & Foa, 2015; Kouyoumdjian et al., 2015). Additionally, entering the penal system in the United States while suffering with an OUD can further exacerbate an already difficult situation. Incarceration presents one of several situations and depends whether that person is incarcerated in a federal prison or a state run correctional facility.

ODU in Federal Prison

The United States Bureau of Prisons (BOP) publishes a clinical treatment manual that directs clinicians within the federal prison system on a prescribed method for detoxification of inmates who present with a current SUD. This manual has not been updated since 2014 (Federal Bureau of Prisons, 2014). The manual follows a theoretical framework of abstinence from opioids and provides little instruction on how to achieve this within 5-10 days.

If medical based treatment is provided, the recommended course of treatment is the use of Methadone until the cessation of withdrawal symptoms, followed by a 10% taper daily until the Methadone is discontinued. Typically, adjunct treatment is included only for withdrawal symptoms in the form of Clonidine, as well as anti-inflammatories,

antipyretics, anti-emetics, and anti-anxiety medication, but not a long-term opioid maintenance MT. In fact, the document states if an inmate enters with a current Buprenorphine use, they are to be detoxified of it and then discontinued.

In addition, the Health Services division of the BOP releases a pharmaceutical formulary document that describes what the pharmacies in federal prisons will have on hand and what they are allowed to dispense and for what reasons. In regards to the use of Buprenorphine, the document reads, “will only be approved for detoxification, [NOT] for pain or maintenance treatment” (Federal Bureau of Prisons Health Services, 2016, p.17). Allowing Buprenorphine for a period of detoxification may allow for a controlled withdrawal and symptom management, however does not assist long-term recovery during their incarceration or after re-entry (Hser et al., 2015b). This is especially important for those using heroin, as it has been demonstrated that abstinence episodes last longer each successive time and are more effective when accompanied by sustained long-term MT (Nosyk, Anglin, Brecht, Lima, & Hser, 2013). It should also be noted that the BOP manual lacks any reference to a counseling or therapeutic model that an inmate may utilize in the recovery.

OD in State Correctional Facilities

Each state has their own policy regarding the use of MT within the correctional system. In some states, correctional facilities provide MT maintenance, while others do not. Rikers Island Correctional Facility (Rikers) in New York is one facility that has treated their inmates who present with OD with MT, more specifically Methadone since as early as 1987. While in other facilities an inmate is provided no medical treatment for opioid withdrawal (Aronowitz & Laurent, 2016).

Besides ignoring the ethical imperative to humanely treat individuals and provide autonomy in healthcare decisions (Ludwig & Peters, 2014; Wakeman, 2017), not providing an MT at the beginning of incarceration has long-term implications for increased mortality and suicidality in the first few weeks of the incarceration experience (Gisev et al., 2015; Larney et al., 2014; Rivlin et al., 2013). A report authored by the Public Health Department of Massachusetts, noted greater than 50% risk of mortality when comparing the opioid deaths of former inmates (869.4/100,000 people) in the state to non-inmate opioid deaths in the state (15.4/100,000 people) (Massachusetts Department of Public Health, 2016).

As noted in the prior section, treatment with continued opioid maintenance agonists or antagonists, is still not prevalent within the U.S. correctional system even though these methods are effective evidence-based medical practices. There are instances where this is occurring and confirming that this a successful, viable treatment methodology for incarcerated populations with an OUD.

Treating inmates during their incarceration has lasting effects during the incarceration experience as well as post-release. Rich et al., (2015) performed a randomized controlled trial involving inmates in a Rhode Island correctional facility. These inmates were randomly assigned to one of two groups upon admission: one a Methadone forced withdrawal group (the current practice in those facilities), and the second, a Methadone continuation group. The findings are supportive of other studies. The continuation group was more likely to seek out and follow-up with Methadone treatment post-incarceration. One striking difference from other studies in regard to mortality, was that the one opioid related death post-release was from the continuation group. Finally, in another small sample feasibility study, buprenorphine treatment

initiated while incarcerated was related to continued treatment after release (Zaller et al., 2013).

Persons with an Involvement in the CJS and MT

Exiting the correctional system with an OUD significantly puts individuals at higher risk for increased morbidity and mortality as well as re-incarceration (Binswanger et al., 2016; Marsden et al., 2017; Merrall et al., 2010). The risk is higher for younger people, women more specifically. In a study of 42,015 recently released individuals, 14,920 of which were young prisoners (<25yr), Van Dooren, Kinner, & Forsyth (2013) determined that the younger group was less at risk for mortality than older, previously incarcerated individuals. However, poisoning by drugs was the leading cause of death for the younger group with men at 43% and women 50%. In this sample, younger individuals were six times more likely to die than their community peers; younger women were 20 times more likely to die.

Treating those with OUD at the beginning of their incarceration with MT has been demonstrated to significantly affect their health, mortality, and re-offending post-release. Researchers for the Australian government compiled four sets of data pertaining to mortality, re-entry of prisoners, addiction, and a general offender database (Gisev et al., 2015). One significant finding was that initiating MT at the entry to incarceration resulted in a 93% reduction in unnatural deaths (drug overdose) within the first four weeks of post-release. Combining records of post-release mortality, re-entry, and MT continuation, Gisev et al. further determined that drug use accounted for death the most. Examining post-release differences between those in MT and those not in MT, those in MT had the smallest crude mortality rate (CMR) at 6.4 per 1,000-person years and those not in MT had a CMR of 36.7 per 1,000 person years.

Likewise, Marsden et al. (2017), found that initiating MT upon release also had a similar effect. Utilizing a prospective cohort of 15,141 subjects across 32 British National correctional facilities, they found a significant relationship between initiating MT upon release and a decline in mortality. With 18 drug related deaths within the first four weeks post-release, only three were found to be within the group currently prescribed MT.

Degenhardt et al. (2014), demonstrated similar findings with a cohort of 16,453 people who had a total of 60,101 prison releases over a period of 12 years. Half of this group was given MT upon release. Of the 1050 deaths that occurred, 135 (13%) happened within the first 4 four weeks. They found that exposure to MT in the form of opioid substitution, limited the death rate by 78% for those re-entering prisoners within the first month of re-entry.

One possible way to mitigate these issues is to have the incarcerated population with a dependence on opioids, initiate MT upon arrival. While MT has been shown to be successful as a treatment modality for incarcerated prisoners evidenced by a lower recidivism rate, a decrease in cravings for opioids, and lower rates of sexually transmitted infections (Aronowitz & Laurent, 2016), understanding the effect that PTS will have on the relationship of MT and having a history of incarceration, will allow clinicians to treat those who suffer from OUD and PTS more effectively. Since MT has not become commonplace in incarcerated settings, few studies have examined MT in the prison setting (Hedrich et al., 2012).

Of the few studies related to describing the outcomes of MT on incarcerated individuals both in the correctional setting and upon re-entering the community, initiating MT while incarcerated has been found to have significant effects on re-incarceration after

having re-entered the community. Larney, Toson, Burns, & Dolan (2012), utilized a random control trial to assess MT in incarcerated men who inject heroin. The researchers found that while overall, initiating MT pre-release, did not significantly reduce re-incarceration. However, those that stayed in the prescribed MT after release reduced their re-incarceration risk by 20%. In contrast, while Gordon et al. (2017) demonstrated a longer period of time in treatment for those initiating Buprenorphine pre-release vs. those starting post-release, they did not demonstrate a significant difference in relation to using opioids post-release and re-incarceration. This may be attributed to a lack of linking patients to treatment, monitoring subjects closely, and a short time period of induction to dosing of only 3-6 months pre-release (Vocci et al., 2015). In addition, there was insufficient study power and there was not a true control group of a re-entered people not taking MT.

Buprenorphine appears to be favored by those with and OUD that are incarcerated when compared to methadone. When treatment was initiated during incarceration using either buprenorphine or methadone, individuals preferred buprenorphine (Awgu, Magura, & Rosenblum, 2010) and subjects further stated that they would be more willing to use buprenorphine post-release. This preference for buprenorphine was based on subject responses that buprenorphine was more effective, presented less side effects, reduced cravings more than methadone, and that it took effect quicker. In an additional study, those subjects treated with buprenorphine pre-release were more likely to continue to arrive for their appointments at a community treatment center more than the methadone treatment group. They also found that 5 of their methadone group switched post-release and switched from the methadone treatment to the buprenorphine group (Magura et al., 2009). This preference for remaining in treatment and a greater affinity for

buprenorphine may be related to concern on the part of the subjects to limit withdrawal from methadone, and a more effective response.

Many studies have primarily focused on re-incarceration, mortality, and treatment continuation as general outcomes (Hedrich et al., 2012). Outcomes such as cravings, relapses, retention of employment, and co-occurring PTS symptoms, should be considered to further understand the implications of starting MT programs in more jails and prisons.

Gender Differences in MT during Incarceration

The literature examining the impact of MT during incarceration has identified some difference based on gender. For example, Farrell & Marsden (2008) found that women had a risk of mortality that was 10 times greater than men in the first week of release from prison and only dropped to 8 times greater at 52 weeks post-release. When women initiated treatment with buprenorphine while incarcerated, Gordon et al. (2017) determined that women were more likely to resist using opioids for a greater length of time than their male cohort, suggesting that if more women were treated while incarcerated, there may be the opportunity to decrease mortality post-release.

Persons with a History of Incarceration and PTS

Of the 20.5 million with a Substance Use Disorder (SUD), approximately 1.4 million are currently incarcerated individuals (Fox, 2015). Of those prisoners, approximately 40% report having Post-Traumatic Stress (Flatt et al., 2016). This is especially true for both men and women entering incarcerated settings have also been shown to have higher rates of childhood trauma (Giarratano, Ford, & Nochajski, 2017). Those who were exposed to trauma before incarceration also show an increase of trauma symptoms while incarcerated (Schappell et al., 2016).

Diagnosis of PTS within the penal system is laden with issues and leads to inaccuracies in terms of who is and is not diagnosed with PTS. Depending on the prison, some provide a self-report questionnaire to ascertain whether or not this person has been diagnosed with PTS or experiences symptoms of PTS (Beck et al., 2013). This leads to problems when people who over report diagnoses with PTS require additional resources and care, while some who have not been formally diagnosed yet experience symptoms of PTS and often underreport these symptoms (Oguntoye & Bursztajn, 2009).

Reporting on the diagnosis of 201 women prisoners with or without PTS, Warren, Loper, & Komarovskaya (2009), found that 97% experienced some type of trauma in their life and those who met the diagnostic criteria for PTSD reported 6.6 trauma experiences, compared to 4.8 experiences for those who did not meet criteria. While there was a variety of traumas experienced, they determined that it was the cumulative number of traumas that appeared contribute to a diagnosis of PTSD, not trauma type.

Warren et al. (2009) pointed out that symptoms of PTS often occur with other diagnoses or without a specific diagnosis and warn against diagnosing inmates just from a report of symptoms. It should be noted that these women also felt that experiencing a trauma such as a mugging, rape, or physical abuse, described these experiences as being as traumatic to them as witnessing an act of violence towards another person. This is closely supported by Swopes, Davis, & Scholl (2017) who reported finding that the incarcerated women in their study rated witnessing an act of violence third behind being assaulted with a deadly weapon and unwanted sexual contact before the age of 13. They also found that women rated witnessing trauma more traumatic than unwanted sexual contact before the age of 18 and being attacked without a weapon.

For women with PTS and also being incarcerated, witnessing trauma is likely and therefore concerning as this has implications to expose inmates to further trauma while incarcerated (Beck et al., 2013; Hagan et al., 2017). People who have been incarcerated or are presently incarcerated often feel unsafe, exhibit increased anti-social behavior, and symptoms of trauma due to circumstances related to, but not limited to, childhood trauma, domestic violence, and military violence pre-incarceration (Schappell et al., 2016).

Re-entry Into the Community with PTS

Experiences before, during, and after incarceration all contribute to individual levels of levels of PTS. Schappell et al. (2016) assessed the trauma symptoms of 100 men who had previously been incarcerated. Being victimized during incarceration demonstrated a significant relationship to higher levels of PTS. Having a mental health issue prior to incarceration was also found to moderate the severity of victimization and thus PTS. Men that re-entered their communities but did not live in a half-way house or with family experienced the highest amount of PTS. Remarkably, of the 100 men in the study, only 11 stated that they had not witnessed or been the victim of violence while incarcerated.

Results from an epidemiologic study of 5008 people by Anderson, Geier, & Cahill (2016) confirm similar findings to Schappell et al. (2016) that having more traumatic life events was related to an increase in having a history of incarceration. This study also examined trauma type. Being in a car accident was one of the weaker predictors of incarceration (AOR=1.7), while being physically beaten was the strongest predictor (AOR=3.5). Having a trauma experience that potentially would potentially lead to death resulted in a three time increase in the likelihood of incarceration. Schappell et al.

also found that individuals with a lifetime diagnosis of PTSD were twice as likely to be incarcerated than those without PTSD. Limiting further trauma experiences and linking to treatment post-release is imperative to reducing not only further opioid use, but further involvement with the criminal justice system.

While PTS itself is a risk factor for increased incarceration, this is especially evident for black men. Having PTS increases the odds of being arrested, jailed, imprisoned, and having experienced at least four or more incidents of trauma (Jäggi et al., 2016). Anderson, Geier, & Cahill (2016) demonstrated that incarcerated black men also were at greater risk for PTS than their peers who had not had a history of incarceration.

Gender Differences of PTS and Incarceration

While 18% of the overall incarcerated population will present with some mental health diagnosis, gender differences are also present. Women are more likely to be diagnosed with post-traumatic stress, substance abuse, and depression (Al-Rousan et al., 2017). Incarcerated women with PTS have experienced trauma in a variety of ways before entering jail or prison. This ranges from unwanted sexual contact from a young age, witnessing acts of violence toward others or animals, torture, and physical assault (Harner et al., 2015). While Giarratano et al. (2017) found there to be no significant gender differences in terms of the occurrence of behavioral problems associated with PTS between male and female inmates, women displayed more PTS symptoms compared to men as well as a greater risk of use of heroin or cocaine. Men with PTS have been noted to seek out after-care treatment post release for their PTSS more than men without PTS (Kubiak, 2004). An explanation for this could be that they were victimized during incarceration that they did not face previously in the community. Since women have

historically been victims of trauma pre-incarceration more than men, release to the community where they have previously experienced trauma may contribute to greater relapse and further exacerbating PTS.

Persons with an Involvement in the CJS, PTS, and OUD

As demonstrated earlier, PTS and OUD combined, as well as incarceration and OUD combined, have the potential to seriously disrupt individual and public health. Results are mixed in regard to studies that include incarceration or a history of incarceration, mental illness, and opioid use. This could present challenging treatment issues for incarcerated populations with PTS that are re-experiencing trauma or living through initial trauma while incarcerated and then later treated for OUD after release. As this is a group that may not be receiving psychiatric treatment while incarcerated as well as not receiving MT, it is possible that this population would be tough to recruit to treatment as well as maintain compliance with treatment protocols.

For instance, Swopes, Davis, & Scholl (2017) struggled to find between-group differences in their dual treatment of women experiencing co-occurring PTS/OUD while incarcerated. While the women in the study were able to decrease cognitions of PTS post-treatment, there was not a significant between-groups interaction that showed marked differences.

Greenberg & Rosenheck (2014) found a significant relationship between mental health, substance use, and re-incarceration. They determined that while race/ethnicity and recent immigration did not present a greater risk for a history of incarceration, being male, not having finished high school, and being young were positively associated with having an incarceration history. They also determined that those with a SUD were at greater risk for longer incarcerations.

Robertson et al. (2018) compared the use of methadone, buprenorphine, and naltrexone for those with an OUD, mental illness diagnosis and involvement to some extent in the criminal justice system. Their results showed only a 3% risk in the incarceration rate for those being treated with buprenorphine compared to the comparison group. However, the methadone and naltrexone groups showed a 39% and 62% greater risk of incarceration respectively.

Functional status/outcomes (Substance Abuse and Mental Health Services Administration, 2012) are still not prevalent measures in follow-up studies with this particular sub-group. For instance, Zlotnick, Johnson, & Najavits (2009) studied PTS/SUD treatment outcomes while utilizing a cognitive behavioral treatment developed by Najavits (2002) called Seeking Safety. Using a randomized control trial of treatment with Seeking Safety compared to treatment as usual, they studied a sample of women recently incarcerated who had co-occurring PTS/SUD. Although appearing underpowered in their sample size of $n=49$, they employed common measures including addiction assessment tools and self-reports of treatment satisfaction, and re-incarceration (the only functional status outcome). They did determine that 22% of those in the treatment group returned to prison within 6 months, compared to 45% in the non-treatment group.

Racial Differences in Incarceration, PTS, and OUD

While Greenberg & Rosenheck (2014) found that black men had a 13% higher incarceration rate and found that black men were 2.5 times more likely to have longer sentences to fulfill. This could pose several problems for black men, but especially black men that have an OUD. As they stay incarcerated for longer, more than likely without

treatment, and have the possibility of experiencing more trauma, they are potentially at greater risk for having a tough recovery after they are released.

Theoretical Framework

To understand the relationships between trauma, coping and outcomes of opioid treatment, Lazarus and Folkman's *Transactional Stress* theory will be applied as a framework within which to view OUD treatment for patients with potential maladaptive coping strategies developed while dealing with co-occurring OUD and PTS.

Lazarus and Folkman (1984) situate their *Transactional Stress* theory within the framework of people experiencing stress in a myriad of ways throughout their individual life cycle. While not developed initially for addiction-based contexts, this theory is especially pertinent to apply to addiction treatment and this particular study. The current study hypothesizes that stress, in the form of traumatic stress from life experiences and particularly stress of incarceration is what in effect causes individuals to not only use opioids in the first place or exacerbates a chronic use, but also restricts them from recovering in the same manner of those who have not experienced stress in the same manner.

Stress

The traditional concept of stress is that stress is a stimulus followed simply by a mental or physiological response. Lazarus and Folkman (1984) reject this concept in favor of a more fluid and flexible one. This concept of stress is focused on the relationship between person and environment. Depending on both of these variables, the confirmation of stress is based on the cognitive appraisal of the specific person and not people in general. The underlying use of stress theory for Lazarus and Folkman is that

individuals possess varying resources and either respond or fail to respond to stress and traumatic experiences accordingly.

Appraisal

For Lazarus and Folkman (1984), cognitive appraisal is the formation of thoughts regarding a specific environment or situation based around the idea of well-being and limiting vulnerability. People appraise events in regard to whether or not the results will bring them harm or will be beneficial. It should be noted that these appraisals are ongoing and are not always fully thought out decisions, but cognitively happening at all moments. They delineate three specific forms of appraisal: irrelevant, benign-positive, and stressful.

Irrelevant

Irrelevant appraisal is the act of appraising a situation and deciding that this has no inherent cause for concern or excitement and therefore is disregarded.

Benign-Positive

Appraising an encounter or environment and deciding that this is in fact beneficial instead of threatening to well-being, would be seen as Benign-Positive.

Stressful

Appraising a situation as stressful includes three potential concepts: fearing some harmful experience, one that brings a threat, and one that potentially presents a challenge. Harm can arrive in a multitude of ways i.e. physical, mental, social, or loss of a loved one. Threatening situations cause stress because they have yet caused harm but have the potential to do so and this in and of itself creates an anticipatory stress. Challenges can be both beneficial and harmful. Perceiving a challenge inherently allows us to first think of the benefit that we can derive from successfully navigating the challenge. However,

Lazarus and Folkman (1984) point out that challenge and threat can be extremely similar as a cognitive appraisal. One may see potential benefits from a challenge, but then also immediately formulate the idea of the threat and vulnerability of not succeeding within the challenge. Appraisals can also be regarded as time-oriented or successive.

Lazarus and Folkman (1984) consider appraisals of similar situations to be primary, secondary, and reappraisals. As one continues to reappraise situations, they may employ more effective coping mechanisms and thus find successful resolutions to stressful situations. These are indeed meaningful. Instead of a group of automatic behaviors that are a programmed response.

Coping

Traditionally, coping was identified as the way that people control a situation or their response to a situation to limit the overall affect it may have on them. Lazarus and Folkman (1984) define coping as, “constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person” (p. 141). They chose this definition based on the premise that this understanding of coping included the ability for the individual to change within different situations rather than having one trait that automatically gave them a defined way of responding to the situation. This is a similar concept to resilience.

Mechanism of Theory

Lazarus and Folkman (1984) describe appraisal and coping as *mediating processes*. Antecedents of these processes include the person’s sense of control and the environment in which demands, or harm are perceived. These initiate mediating processes to be enacted as the person moves through successful iterations of appraising and then enacts certain coping strategies. The connection between emotion and coping is

also described by Folkman & Lazarus (1988) as a bi-directional processes. It is not coping that affects emotion or vice versa. Their view is that one can affect the other in either direction. Furthermore, Folkman & Lazarus found coping or lack of coping to be a mediator of emotion in stressful encounters. These lead to immediate effects related to physiological and psychological changes. This then potentially promotes long-term effects such as somatic health/illness or positive/negative social functioning. This is illustrated in Table 1.

Table 1. A theoretical schematization of stress, coping, and adaptation (Lazarus and Folkman, 1984, p.305).

Causal Antecedents	Mediating Processes	Immediate Effects	Long-Term Effects
Person variables: values commitments Beliefs: sense of control Environment: situational demands, constraints Resources: (e.g., social network) Ambiguity of harm & imminence of harm	Primary appraisal Secondary appraisal Reappraisal Coping: Problem-focused Emotion-focused Seeking, obtaining, and using social support	Physiologic changes Positive/Negative feelings Quality of encounter outcome	Somatic health/illness Morale (well-being) Social Functioning

Relation of Theory to OUD

Managing emotions and employing effective coping strategies has been shown to provide a protective factor against substance use. Employing a problem-based coping strategy rather than an emotionally-based coping strategy reduces poor self-efficacy and

thus allows a person to work through their stressor rather than distance themselves and use substances as a means of coping (Rabani Bavojdan, Towhidi, & Rahmati, 2011). Bavojdan et al. (2011) also demonstrated that those who perceived themselves in less control of their lives and sensing that the external environment was more in control of them, were more likely to have a substance use disorder (SUD). This has been further supported by the work of Hassanbeigi, Askari, Hassanbeigi, & Pourmovahed (2013).

Counseling/Training in OUD

Lazarus and Folkman (1984) posit that training a person to first recognize stressors and appraise them thoughtfully and from a problem-centered framework will allow them manage emotions and cope more effectively. This is supported by the Substance Abuse and Mental Health Services Administration (SAMHSA) and the American Society of Addiction Medicine (ASAM), both of which encourage counseling as an adjunct to medication treatment (MT) (American Society of Addiction Medicine, 2015; Substance Abuse and Mental Health Services Administration, 2016).

Theoretically speaking, as any person experiences a stressor, they would first likely appraise that from an emotional point of view. They would then make a second appraisal which would ideally be derived from a problem-focused viewpoint which would then inform a decision of how one wants to act in this situation. This is delineated as both a cognitive decision as well as a physiologic reaction to the stressor. This would ideally result in a positive long-term adaptation that would allow that person to have a beneficial or adaptive reaction to that particular stressor that next time it occurred in their life (Figure 1).

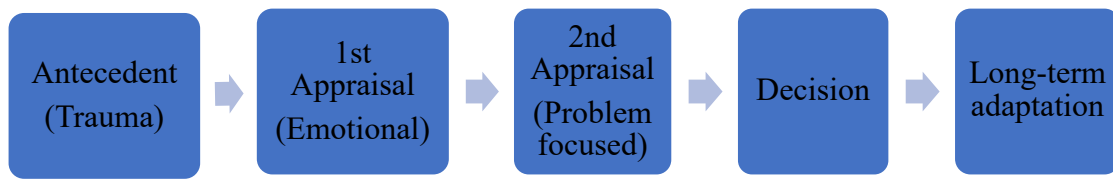


Figure 1. Theory applied to successful coping and appraisal.

Medication Treatment, PTS, and Involvement in the CJS

Using opioids in the setting of experiencing symptoms of post-traumatic stress represents a lack of coping and appraisal based on the inevitability of harm. To reduce harm and vulnerability, the individual turns to opioids as a coping strategy. Withdrawing and not using opioids represents both a threat for the individuals included in MT. The threat perceived can be viewed in a social or neurobiological context. Socially, the perceived threat is that one will have to inevitably live among potential stressors without using opioids as a coping strategy. Neuro-biologically, the individual risks the threat of not only feeling ill, but also failing to re-establish their normal neurologic state free of opioids. This study further hypothesizes that for a large set of people in recovery, there may be multiple instances of relapse due to perceived stress and lacking fundamental appraisal and coping mechanisms.

Incarceration, as hypothesized in this study, has the potential to be acted upon by post-traumatic stress. PTS has the potential to generate further stress and a lack of coping and appraisal upon the person with an incarceration history.

However, as Lazarus and Folkman (1984) remind the reader, threats can also represent positive challenges. For instance, consider an individual participating in MT at an addiction treatment center. Upon appraising the outcomes after staying free of drugs,

one may perceive the inherent benefits of remaining employed, visiting or living with their children, feeling healthy, and reviving intimate relationships.

Lazarus and Folkman (1984) theorize that the continued appraisal and coping, will inevitably lead to long-term adaptation and proper management of emotions. Again, this relates to those within MT. As relapse happens, the general desire is for the length of time between each relapse to progressively become longer and longer. This can contribute to recovery in that Lazarus and Folkman's long-term adaptation allows the person to continually make re-appraisals that will determine how a person will cope with their environment and stressor at a later trajectory in their lives. This is demonstrated in Figure 2.

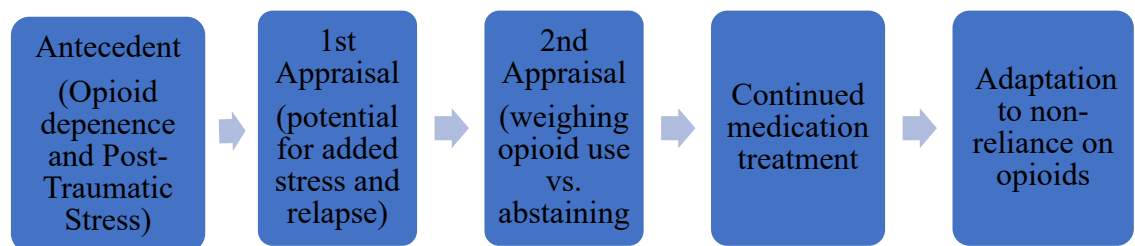


Figure 2. Theory applied to successful coping and appraisal within OUD treatment.

As a person with OUD and PTS are in MT, when they meet a potential stressor the first action is to appraise this from an emotional viewpoint. They then reappraise this with a problem-solving framework that allows them to employ coping strategies to effectively remain drug free and continue with MT. This continuation of MT without the use of opioids allows them to continue adapting to life without a reliance on opioids.

Theoretical Framework Summary

Lazarus and Folkman's (1984) Transactional Stress theory as outlined in *Stress, Appraisal, and Coping* theorizes that human beings live within an environment that is inherently stressful for individual reasons. As people navigate this environment, they are

continually (consciously or unconsciously) reacting to these stressors. If successfully experiencing these stressors, people inevitably appraise these situations based mostly from a problem-solving perspective. They theorize that as people appraise from only an emotional perspective, they may not make purposeful, coping oriented decisions which can contribute to maladaptive mental and physical health.

As people in recovery are often experiencing an onslaught of stress on a daily, sometimes, minute to minute basis, viewing their capacity to appraise situations from the Transactional Stress model allows us to understand recovery and relapse from an emotion and problem-solving framework. As people in recovery continue to calm their brain and thus nervous system with medication treatment, they generate physiologic adaptation to stress. From here they can also learn to appraise their stressors appropriately from an emotional viewpoint and then move to an appropriate problem-based strategy to move themselves forward. The goal is that by moving forward consistently, the person develops resilience and a long-term adaptation to that stress that would require less and less dependence on opioids for coping.

Significance of the Study

Opioid addiction can lead to death, criminality, numerous co-morbidities, re-incarceration for previously incarcerated individuals, increased exposure to HIV and hepatitis C, and neonatal abstinence syndrome for newborns (NIDA, 2015). Those with PTS and a history of incarceration are at greater risk for these outcomes. It is imperative to understand the relationship of PTS to MT to enable clinicians to intervene more appropriately and enhance treatment outcomes for those with co-occurring PTS and participating in MT. Understanding how these interactions will also affect the recovery

process for those that have been incarcerated and will aid in long term success and adaptation.

Viewing involvement in the criminal justice system through the lens of Lazarus and Folkman's Transactional Stress theory, incarcerated men and women are already shown to be a greater risk when entering the system with a history of PTS. As this PTS is exacerbated in an incarceration experience, it is hypothesized in this study, that PTS may moderate or strengthen the relationship between incarceration and successful OUD treatment outcomes. Those with PTS and an incarceration history are at even greater risk for inappropriate appraisals of stress that could potentially become heightened after leaving prison or jail and entering OUD treatment. Inaccurately appraising situations from a place of fear and trauma could result in the action to relapse and use substances once again.

Developing a clearer understanding and framework for treatment within this subset of the population will allow clinicians to treat other groups of individuals suffering from the combination of PTS and OUD. Veterans, sexual abuse survivors, refugees, or other individuals living with PTS and OUD will benefit from the approaches and practices that can be instituted as a result of the data gathered from this proposed study. Understanding these relationships more clearly will enable clinicians to intervene more appropriately when presented with someone with co-occurring PTSD and participating in MT. Understanding how these interactions affect those with involvement in the criminal justice system who are in the process of recovery will aid in long term success.

CHAPTER 3

METHODOLOGY

Methods

This chapter provides an overview of the research methodology that will be utilized in the proposed study. The chapter ends with a conceptual definition of variables.

Research Purpose

The purpose of this study is to explore the relationships between post-traumatic stress (PTS), involvement in the criminal justice system (CJS), and medication treatment (MT) success in patients identified with an Opioid Use Disorder (OUD).

Research Design

This study will employ a correlational retrospective analysis of Electronic Health Records (EHR) data.

Electronic Health Record / Retrospective Chart Review

Since the inception of EHR, the ability to utilize these records beyond the scope of daily patient care and billing purposes has continued to merge into the field of research as a method to track all patient data for use either prospectively or accessed retrospectively. The current utilization of EHR is commonly referred to as ‘clinical data reuse’ or ‘retrospective chart review’. This reuse of data is employed in research realms such as: epidemiology, genomics, safety, clinical/treatment, and outcomes based research (Meystre et al., 2017).

Advantages of the EHR Chart Review

There are numerous advantages to EHR chart review. A major benefit of chart reviews is that they are not as costly as experimental studies that require multiple staff,

locations, instruments, etc. They are efficient uses of time as one can immediately derive data from a lengthy time period rather than conducting longitudinal experiments that may take years to conclude (Gearing, Mian, Barber, & Ickowicz, 2006). Importantly, there may be instances in research when a researcher does not have the ability to randomize people for a variety of reasons. EHR chart review is an especially poignant methodology in these cases (Worster & Haines, 2004).

Disadvantages of the EHR Chart Review

While the benefits of EHR chart review are substantial, there are drawbacks. Data itself needs to be input into a medical record. This initial input to the record itself can be suspect due to user error from the standing of the provider (Zozus et al., 2015). Data abstractors, or those who code and maintain the data, may not always be consistent and therefore increase the likelihood that data is retrieved in an inconsistent manner (Polnaszek et al., 2016; Vassar & Holzmann, 2013). Documenting research conducted using a chart review often does not include a thorough methodology that was utilized during data abstraction and analysis.

Data Mining EHR

EHR contain data that are either structured or unstructured. This refers to the classification of data in a manner that is already accessible in a format that can be utilized immediately for research. Unstructured data refers to data that is in an unclassified textual format (Meystre et al., 2017).

Advantages of Data Mining

Textual, unstructured data is often found in the form of written notes of physicians or clinicians, nurses, and other auxiliary care personnel. Extracting this data

has the opportunity to provide useful data that may not be contained in the basic, formalized EHR.

Disadvantages of Data Mining

One major drawback to data mining is that clinicians are not typically charting everything that occurs or is witnessed in a visit. Other times, some clinicians only chart by exception, meaning that only when the patient presents findings outside the normative expectations are they noted. There are times when data is missing or contrary to other data within the EHR (Zozus et al., 2015).

Setting and Sample

Data was provided pertaining to patients receiving treatment at a multi-state, multi-site, office-based outpatient addiction treatment center that primarily provides medication treatment to patients with opioid use disorder. Patients meeting criteria for an *opioid abuse disorder* according to the Diagnostic and Statistical Manual of Mental Disorders (Fifth edition) (APA, 2013) are permitted to receive treatment at the center. Upon admission, each patient undergoes a biopsychosocial assessment. Following this assessment, an individualized treatment plan for each patient is developed. All sites within the treatment organization have access to and utilize an electronic health record (EHR) that provides robust monitoring. This allows all physicians and nurse practitioners the ability to provide individualized care planning and management.

Opioid use disorders are primarily treated with buprenorphine in an outpatient setting. The treatment center employs evidence-based treatment for a range of substance use disorders (SUD), however most patients receive treatment for an opioid use disorder (OUD). Given the focus of the study, only patients who received treatment for OUD will be included in analyses. As numerous changes have occurred at the protocol level within

the EHR, patients who received treatment between January 2016 and February 2018 will be included to provide the most consistent treatment protocol. Prior to analyses, patients under the age of 18 will be removed from the data file. This accounts for approximately 1% of the patients treated at the treatment centers.

Thus, in summary, inclusion criteria are patients who received treatment at an outpatient treatment facility who received OUD care between January 2016 and February 2018 who received buprenorphine MT treatment. Exclusion criteria are patients who are under the age of 18.

Sample Size

An important aspect of planning a research study is determining the sample size. Ideally, the sample represents the population from which it is drawn so that findings can then be generalized to the target population (Kadam & Bhalerao, 2010). The sample size depends on several elements: the acceptable level of confidence, power of the study, expected effect size, underlying rate of the condition under study in the population, and standard deviation in a population (Kirby, Gebiski, & Keech, 2002).

Power Analysis

Using G*Power 3.1.9.2, a power analysis was performed to estimate the required sample size. In the analyses, the following parameters were used: power = 0.80, alpha = 0.05, and w = 0.1 (df=1). The effect size was based on a small effect size for contingency table goodness of fit test. Based on these parameters, a sample size of 785 is required for sufficient study power. The database provided included data for 19,970 patients, thus there was ample power to complete this study.

Operational Definition of Variables

The electronic health record (EHR) contains all the information that will be used in this study. A description of all study variables is provided below.

Predictors

There are four main predictor variables in this study: Post traumatic stress symptoms, a history of trauma, a history of involvement in the criminal justice system, and gender. All four of the predictor variables are dichotomous and nominal.

Post-Traumatic Stress

During patient intake, patients provide an extensive medical and social history. There are several locations in the EHR where data related to PTSD history could be entered by a provider. Each of these fields is in free text format. Each of these fields is in free text format. After translating all text data to lower case, syntax was written to identify cases with a diagnosis of PTSD. The following phrases were identified in the text fields and flagged as trauma positive: ptsd and post-traumatic stress. In addition, a patient with any PTSD diagnosis code was identified as positive for PTSD.

Trauma

Similar to PTSD, during patient intake, patients provide an extensive medical and social history. There are several locations in the EHR where data related to trauma history could be entered by a provider. Each of these fields is in free text format. Text from 500 was examined to identify provider specific phrases used to describe trauma in the EMR. After translating all text data to lower case, syntax was written to identify cases with evidence of a trauma history.

The following phrases were identified in the text fields and flagged as trauma positive: stabbed, gunshot, traumatic, abused, hostage, victim of, rape, traumatic abuse,

childhood abuse, hx abuse, intimate partner violence, domestic violence, gun shot, bullet wound, trauma hx, physical abuse, sexual abuse, emotional abuse, assaulted, abuse as child, stab wounds, beat up, being shot, verbal abuse, bullet lodged, shrapnel, stab injury, sexually abused, physically abused, mugging, traumatic experiences, emotionally abuse, domestic violence, past sexual trauma, violent incident, abusive relationship, stabbing victim, molested, and kidnapped. In addition, a patient with a diagnosis code consistent with trauma was identified as positive for trauma. In addition, any patient identified as PTSD was also identified positive for trauma.

Involvement in the Criminal Justice System

The treatment provider evaluates patient involvement in the criminal justice system i.e. probation, awaiting trial, and past incarceration each quarter when the treatment plan is evaluated. This data is identified via check boxes. Providers are able to check either that there are “pending criminal charges” or “resolved criminal charges.” If a patient is positive for either, they were identified as involved with the criminal justice system. In addition, several patients were identified as having involvement in the criminal justice system through a separate database for patients who were part of a study performed by the treatment center location. All patients in the “Jail Database” were identified as positive for criminal justice system involvement.

Gender

Upon intake, during the patient’s history and physical exam, their gender is noted. This was recorded as either male or female.

Dependent Variables

Several dependent variables will be examined in this study including *visit compliance, medication adherence, and drug use*.

Treatment Compliance

Patients that are more compliant with visits are considered to be progressing in treatment by facility treatment providers (Hser et al., 2015b; Kampman & Jarvis, 2015; Timko et al., 2016). There were several instances to assess visit compliance. There are several types of encounters that are recorded in the EHR each time the patient is scheduled for a visit. These types of visits where an encounter is created include: provider visits, group visits, and random urine screen visits. Patients participate in group therapy treatment focused on OUD antecedents and consequences. These sessions are required as well as periodic random screening for opioid drug use. These encounters are recorded as “no-show” when the patient does not appear for their session. Tracking the number of times a patient does not come to a scheduled provider visit, a scheduled group visit, a random urine screen visit, and cancels group visits provide the opportunity to examine patient compliance.

In the current proposal, the following variables were examined: the number of “no show visits”, number maintenance visits, number of initial visits, number of rejoin visits, number of induction visits, number of group visits, number of no show group visits, number of group cancellations, number of rescheduled visits, number of interruptions, and number of other encounters. In addition, the total time in case and the time since the last visit was evaluated.

Patients with more than one initial visit or more than one induction visit, are having that visit because they had a period of stoppage in treatment. At the treatment facility, a patient is defined as not in treatment if they have not been seen by a provider within the past 30 days. The number of times a patient had more than 30 days outside of treatment was summed and labeled the number of care interruptions.

With the exception of the total time in care and the time since the last visit, all variables were adjusted based on total time in care, by dividing the variable by how long a patient had been in care.

Medication Adherence Since only patients treated with buprenorphine were included in this study, medication adherence was defined as *buprenorphine* positive. Urine screen data is available for every visit for each patient in the EHR. All buprenorphine urine screens were used to create the variable percent positive for buprenorphine. Positive screens were identified as “1”, while negative screens were identified as “0.” All were summed and divided by the total number of buprenorphine urine screens evaluated.

Drug Use

All drug use variables were obtained using the methodology described above. The drugs examined included opioids, benzodiazepines, alcohol, THC, amphetamines, cocaine, PCP, barbiturates, methamphetamines, and ecstasy. Percent positive for each of the drug categories was constructed. A composite opioid values was constructed from the following opioids: ultram, codeine, fentanyl, hydrocodone, hydromorphone, oxycodone, hepridine, morphine, heroin, oxymorphone, propoxyphrene, and methadone. In addition, there is a general opiate screen that was performed. At any visit a patient was identified as positive if any of the opioids listed were positive. Since there was minimal usage of PCP, barbiturates, methamphetamines, and ecstasy, these screens were summed as “other drugs.”

Covariates

In addition to the variables already presented, other variables that were available in the EHR were included in the analyses as covariates. These included age, race,

ethnicity, and treatment center location. Since the sample is predominately white, a white yes/no variable was constructed and used in analyses. Similarly, since the majority of the patients were seen in Massachusetts, a Massachusetts yes/no variables was constructed and used in analyses. Finally, total time in care and time since the last visit were included as covariates when appropriate (i.e., when not the dependent variable).

Measurement of Variables

All variables were obtained from the EHR. The independent variables are nominal in scale. Dependent variables are ratio in scale.

Procedures

The treatment center will provide all data in individual CSV data tables. All data tables were imported into SPSS v25 and merged. Files were merged based on patient MRN number. Prior to receiving the data, a study ID was created for each patient and a de-identified data file was used for analyses. IRB approval from the University of Massachusetts Amherst was received prior to data transfer.

Data Analysis

Prior to beginning study analyses, all variable distributions were evaluated for normality or data entry errors. Descriptive statistics were calculated for all variables. Analyses by study aim are described below.

Aim 1. *To compare outcomes of Medication treatment (MT) success in patients with elevated post-traumatic stress (PTS) and patients without PTS.*

Analyses to examine Aim 1 were performed using ANCOVA. All covariates were entered into the ANCOVA. An ANCOVA was performed for each of the dependent variables. The independent variable PTSD was the between subjects variable. Gender

was also a between subjects variable and the interaction of PTSD and gender was examined.

Aim 2: *To compare outcomes of Medication treatment (MT) success in patients with elevated history of trauma (Trauma+) and patients without a history of trauma.*

Analyses to examine Aim 2 were performed using ANCOVA. All covariates were entered into the ANCOVA. An ANCOVA was performed for each of the dependent variables. The independent variable trauma was the between subjects variable. Gender was also a between subjects variable and the interaction of trauma and gender was examined.

Aim 3: *To compare outcomes of Medication treatment (MT) success in patients with an history of involvement with the criminal justice system (CJS) and patients without a history of involvement in CJS.*

Analyses to examine Aim 3 were performed using ANCOVA. All covariates were entered into the ANCOVA. An ANCOVA was performed for each of the dependent variables. The independent variable CJS involvement was the between subjects variable. Gender was also a between subjects variable and the interaction of CJS involvement and gender was examined.

Aim 4. *To examine if PTS status moderates the relationship between involvement in the criminal justice system and Medication Treatment success.*

Analyses to examine Aim 4 were performed using ANCOVA. All covariates were entered into the ANCOVA. An ANCOVA was performed for each of the dependent variables. The independent variable PTS and CJS involvement were the between subjects variables. Gender was also a between subjects variable and the interaction of PTSD and

gender was examined. Evidence of moderation was evaluated using the PTSD * CJS interaction term.

Aim 5. *To examine if trauma status moderates the relationship between involvement in the criminal justice system and Medication Treatment success.*

Analyses to examine Aim 5 were performed using ANCOVA. All covariates were entered into the ANCOVA. An ANCOVA was performed for each of the dependent variables. The independent variable trauma status and CJS involvement were the between subjects variables. Gender was also a between subjects variable and the interaction of trauma and gender was examined. Evidence of moderation was evaluated using the TRAUMA * CJS interaction term.

Limitations

Term Abstraction

Term abstraction is identified as a potential limit to the study. Term abstraction is the process in which terms related to PTS+ were identified and programmed for recognition by SPSS. The terms themselves may be limiting and may not encompass all terms used by a provider or patient to identify a particular functional outcome. There is also the potential that some terms referring to functional outcomes may be used in the note written by the provider but not recognized due to their novelty.

Protection of Human Subjects

While the use of patient data should always be treated with the highest regard for confidentiality, using de-identified data within a secondary analysis will lessen the opportunity for breach of anonymity. This study will follow criteria set forth by the University of Massachusetts Amherst Institutional Review Board and received board for

approval. All investigators completed the requisite training regarding the protection of human subjects to ensure that no harm comes to patients involved in this study.

CHAPTER 4

RESULTS

This chapter describes the results of the study. It contains pertinent descriptive data used to identify the general characteristics of the study sample and covariates including: age, gender, ethnicity, state of treatment, race. The chapter also outlines the various levels of positive drugs screens throughout the sample. This chapter also provides results based on the predictor variables (PTSD and History of Incarceration) and dependent variables (provider visit compliance, group visit compliance, random visit compliance, medication adherence, and illicit opioid use) utilized within various regression and mediation analyses as outline in the chapter 3.

Sample

The study sample consisted of 19,848 subjects ranging in age from 18-83 years with a mean age of 38.3 years (SD= 10.6). The majority of the sample was male at 57.8% and 69.9% white and received treatment within the state of Massachusetts (69.9%). Just under 10% (9.5%) of the sample have a history of PTSD; while just over 10% a history of Trauma was noted in 12.0% of the sample. A total of 5115 (22.8%) subjects had an involvement in the criminal justice system (see Table 2).

Table 2. Sample Characteristics (N=19,970).

Socio-demographic Variables	%
Sex	
Male	57.3
Race	
White	67.8
Non-white	32.2
Ethnicity	
Hispanic	12.7
Non-Hispanic	87.3
State of Treatment	
Massachusetts	69.9

All other states	30.1
PTSD (% yes)	9.5
Trauma (% yes)	12.0
Criminal Justice Involvement (% yes)	22.8

Relationship between Trauma, PTSD, CJS and Demographic Characteristics

The relationship between PTSD, trauma history, and criminal justice status (CJS) was evaluated via chi-square (see Table 3). Due to high study statistical power, a conservative alpha was used to evaluate statistical significance ($\alpha = 0.05$). Gender was significantly related to PTSD, trauma, and CJS involvement. More women were identified as having a history of PTSD ($\chi^2 = 211.0$, $p < 0.001$) and trauma ($\chi^2 = 234.7$, $p < 0.001$), while more men had a history of CJS ($\chi^2 = 14.0$, $p < 0.001$). Ethnicity was not significantly related to PTSD status ($\chi^2 = 0.009$, $p = 0.925$) or CJS involvement ($\chi^2 = 0.4$, $p = 0.542$), but was significantly related to trauma status ($\chi^2 = 18.5$, $p < 0.001$). Hispanic patients had reported less trauma history than non-Hispanic patients. No significant relationships were found between race and PTSD ($\chi^2 = 3.7$, $p < 0.054$) or trauma ($\chi^2 = 2.1$, $p = .145$). White patients did report a significantly higher CJS ($\chi^2 = 17.1$, $p < 0.001$). As mentioned above, the majority of the patients were treated in Massachusetts (69.9%). Given the small number of patients treated in any of the other individual states, a dichotomous Massachusetts variable (treated in MA yes/no) was created and used in analyses. The state in which the subjects were treated showed significant proportions. Massachusetts has the largest proportion of subjects with PTSD at 11.6% ($p < 0.001$), trauma at 13.2% ($p = 0.009$) and CJS at 24.9 % ($p < 0.001$).

Table 3. PTSD/Trauma/CJS status and demographic characteristics.

	PTSD Status			Trauma Status			CJS Status		
Variables	No (n=17,876)	Yes (n=1,945)	χ^2	No (n= 17,278)	Yes (n=2,543)	χ^2	No (n=15,303)	Yes (n=4,664)	χ^2
Sex	%	%		%	%		%	%	
Male	92.8	7.2	211.0***	90.3	9.7	234.7***	75.6	24.4	14.0***
Female	86.6	13.4		83.0	17.0		77.9	22.1	
Race									
White	89.8	10.3	3.7	86.9	13.1	2.1	76.4	23.6	17.1***
Non-White	95.7	4.3		88.7	11.3		82.8	17.2	
Ethnicity									
Hispanic	89.9	12.6	0.0	90.3	9.7	18.5***	76.9	23.1	0.4
Non-Hispanic	89.8	87.4		86.8	13.2		76.3	23.7	
State									
Massachusetts	88.4	11.6	150.4***	86.8	13.2	6.8**	75.1	24.9	57.6***
Other	94.0	6.0		88.1	11.9		79.9	20.1	

p<.01. *p<.001

Relationship between Trauma, PTSD, CJS and Treatment Compliance

The relationships between treatment visit compliance among PTSD, trauma history, and criminal justice status (CJS) was evaluated via independent sample t-tests (see Table 4) to evaluate for statistical significance. All relationships were significant for all three IV variables evaluated: PTSD (yes/no), Trauma history (yes/no), and CJS (yes/no). Individuals who were positive for PTSD, trauma, or CJS had significantly more “no show” visits than without a trauma history (t 's = -12.6, -19.7, -30.7, all p 's < 0.001 respectively). Similarly, all risk groups for the three variables examined had more group cancellations (t 's = (-2.7, p = 0.007), (-5.5, p < 0.001), (-6.7, p < 0.0010 respectively), group “no show” visits (t 's = -7.4, -15.9, -21.0, all p 's < 0.001 respectively), and reschedules visits (t 's = -11.4, -19.6, -26.5, all p 's < 0.001 respectively). All of these relationships suggest problems with treatment compliance which is supported by significantly more care interruptions for those with PTSD (t = -8.0, p < 0.001), trauma (t

= -5.8, $p < 0.001$) and positive CJS status ($t = -17.7$, $p < 0.001$). However, each of the risk groups for PTSD, Trauma, and CJS have significantly more maintenance visits (t 's = -13.1, -29.8, -37.2, all p 's < 0.001 respectively) and group visits (t 's = -8.4, -22.2, -26.7, all p 's < 0.001 respectively). At risk groups had been in care longer (t 's = -10.1, -25.2, -31.5, all p 's < 0.001 respectively) and had been seen more recently (t 's = 5.1, 23.5, 12.8, all p 's < 0.001 respectively). These data suggest increased compliance. However, more initial visits (t 's = -16.7, -11.3, -22.1, all p 's < 0.001 respectively), more rejoin visits (t 's = -11.8, -13.5, -25.3, all p 's < 0.001 respectively), and more induction visits (t 's = -10.1, -15.1, -25.5, all p 's < 0.001 respectively) for all three risk groups support care interruptions and lower treatment compliance. Overall, the data suggest poorer treatment compliance for all three risk groups.

Table 4. Relationships between PTSD, Trauma, CJS, and Treatment Compliance.

		PTSD Status			Trauma Status			CJS Status		
Treatment Compliance	Total	No	Yes	t	No	Yes	t	No	Yes	t
	Mean	Mean	Mean		Mean	Mean		Mean	Mean	
# no show visits	3.3	3.2	4.8	-12.6***	3.0	5.6	-19.7***	2.6	5.5	-30.7***
Time since last visit (yrs.)	0.6	0.6	0.5	5.1***	0.6	0.3	23.5***	0.6	0.5	12.8***
# maintenance visits	28.1	27.0	40.5	-13.1***	24.5	54.1	-29.8***	21.9	48.5	-37.2***
# initial visits	0.8	0.8	0.9	-16.7***	0.8	0.9	-11.3***	0.8	0.9	-22.1***
# rejoin visits	0.4	0.3	0.6	-11.8***	0.3	0.6	-13.5***	0.3	0.7	-25.3***
# induction visits	0.7	0.7	0.9	-10.1***	0.7	0.9	-15.1***	0.6	0.9	-25.5***
# group visits	1.3	1.2	1.7	-8.4***	1.1	2.3	-22.2***	1.0	2.0	-26.7***
# no show group visits	0.5	0.5	0.7	-7.4***	0.4	0.9	-15.9***	0.4	0.9	-21.0***
# group cancellations	0.0	0.0	0.0	-2.7**	0.0	0.0	-5.5***	0.0	0.0	-6.7***
# rescheduled visits	3.2	3.1	5.0	-11.4***	2.8	6.0	-19.6***	2.5	5.6	-26.5***
Total time in care	1.1	1.1	1.4	-10.1***	1.0	1.9	-25.2***	0.9	1.7	-31.5***
# of interruptions	0.8	0.8	1.0	-8.0***	0.8	1.0	-5.8***	0.7	1.1	-17.7***
# other encounters	25.6	24.4	37.7	-16.7***	22.7	46.4	-31.2***	19.9	41.3	-51.0***

p<.01. *p<.001

Relationship between PTS, Trauma, & CJS and MT Adherence & Drug Use

Medication Adherence

The relationship between PTSD, trauma, and CJS and medication adherence was evaluated using independent t-tests (Table 5). Mean percent positive buprenorphine screens were significantly higher for individuals positive for PTSD, trauma, or CJS (t's = -6.4, -21.9, -21.8, all p's < 0.001 respectively). These data show increased compliance for medication for all three at risk groups. These data do not support the hypothesis that individuals with trauma history, PTSD, or CJS are less compliant with MT.

Drug Use

The relationship between PTSD, trauma, and CJS and drug use was evaluated using independent t-tests. Those positive for PTSD, trauma, and CJS had significantly lower mean percent positive for opioid screens (t 's = 6.7, 16.5, 17.1, all p 's < 0.001) suggesting better outcomes for all three risk groups. However, all three risk groups had more positive amphetamine screens (t 's (-4.7, p < 0.001), (-6.9, p < 0.001), (-3.0, p = 0.003 respectively). Individuals with PTSD had more cocaine screens (t = -4.0, p < .001) and alcohol use (t = 2.4, p < .016). None of the three risk groups had significantly more other drug use. There was less methadone use in patients with trauma and in patients positive for CJS. Finally, patients with PTSD and trauma had significantly more benzodiazepine screens (t 's = -11.2 and -6.3, both p 's < 0.001 respectively).

Table 5. Relationship between medication adherence and drug use by PTSD/Trauma/CJS

	Total Sample	PTSD Status			Trauma Status			CJS Status		
Drug (% positive)		No	Yes	t	No	Yes	t	No	Yes	t
Buprenorphine	76.5	82.4	86.2	-6.4***	81.4	90.9	-21.9***	80.5	89.1	-21.8***
Opiates [†]	15.3	16.0	13.2	6.7***	16.5	11.0	16.5***	17.1	12.1	17.1***
Amphetamines	5.5	5.6	7.6	-4.7***	5.4	8.0	-6.9***	5.6	6.4	-3.0**
Cocaine	16.1	16.2	19.1	-4.0***	16.7	15.7	1.8	16.3	17.2	-1.9
THC	33.1	33.3	37.3	-4.1***	33.7	34.3	-0.8	33.9	33.7	-0.2
Alcohol	15.0	14.7	13.3	2.4	14.6	14.3	0.7	14.7	14.1	1.5
Other ^{††}	7.2	7.3	8.0	-0.6	7.1	8.6	-1.8	7.1	8.0	-1.2
Methadone	2.2	2.2	2.0	1.1	2.3	1.6	3.9***	2.5	1.3	9.0***
Benzodiazepines	9.3	8.7	13.8	-11.2***	9.0	11.2	-6.3***	9.3	9.3	-0.3

p<.01. *p<.001

[†] – Ultram, codeine, fentanyl, hydrocodone, hydromorphone, oxycodone, hepridine, morphine, heroin, oxymorphone, propoxyphrene.

^{††} – PCP, barbiturates, methamphetamines, ecstasy.

Summary

In summary, patients who received treatment in Massachusetts, were white, non-Hispanic. Almost 25% of the sample had some involvement in the criminal justice system, 9.5% had PTSD, and 12% had a history of trauma. Patients in each risk groups showed poorer treatment compliance with more “no show” provider and group visits and a higher number of overall encounters. These risk groups also had a higher frequency of attendance to maintenance visits. Patients with PTSD, trauma, and CJS had better medication adherence, but mixed results in drug screen results.

Analysis of Study Aims

AIM 1 –To compare outcomes of Medication treatment (MT) success in patients with elevated post-traumatic stress (PTS) and patients without PTS.

To examine the relationship between PTSD, Trauma, and CJS, several ANCOVAs were performed. The between-subjects variable for all analyses were either PTSD history (yes/no), trauma history (yes/no), CJS involvement (yes/no) and gender (male/female). Dependent variables included measures of treatment compliance, medication adherence, and drug use. In addition to main effects, gender by PTSD, Trauma, or CJS interaction terms were evaluated. The covariates in the analyses included race, treatment state, age, ethnicity, total time in care, and time since last visit. For study aim analyses, a more conservative level of statistical significance was used ($\alpha = 0.01$) due to high statistical power and the number of comparisons being evaluated.

Relationship between PTSD and Treatment Compliance

After including covariates, there were many significant differences in treatment compliance by PTSD history. Individuals with a history of PTSD had more “no shows” for maintenance visits ($F(9, 12853) = 83.0, p < .001$) than individuals without a history of PTSD, but there was no difference in frequency of “no shows” for group visits ($F(9, 12853) = 2.2, p = 0.155$). Individuals with PTSD had more initial visits, rejoin visits, inductions, and care interruptions ($F(9, 12853) = 83.0, p < .001$), ($F(9, 12853) = 61.4, p < .001$), ($F(9, 12853) = 45.2, p < .001$), ($F(9, 12853) = 19.4, p < .001$ respectively) than individuals without a history of PTSD. When an individual lapses from the program, as evidenced by increased care interruptions, and “rejoins” the program, they will have another initial visit and induction visit. Thus, there is evidence that individuals with PTSD have more care interruptions than individuals without a history of PTSD suggesting poorer treatment outcomes (see Table 6).

Supporting data includes individuals with PTSD also had more total encounters ($F(9, 12853) = 140.0, p < .001$). After controlling for the amount of time in care and the

time since the last visit, staff interacted with patients with a history of PTSD more than individuals without a history of PTSD. Although individuals with a history of PTSD rescheduled their maintenance visit more frequently ($F(9, 12853) = 24.0, p < .001$), they also had more overall maintenance visits ($F(9, 12853) = 36.0, p < .001$). Finally, there was also a significant relationship between PTSD status and total time in care ($F(8, 12854) = 20.3, p < .001$) and the time since the last visit ($F(7, 13369) = 23.5, p < .001$). Patients with a history of PTSD were in care longer and had a shorter length of time since they were last seen.

Table 6. Relationship between Treatment Compliance and PTSD, Gender, and PTSD*Gender.

Treatment Compliance	PTSD	Gender	PTSD X Gender
	F	F	F
# no show visits	45.1***	11.6***	0.4
# initial visits	83.0***	5.0	2.2
# rejoin visits	61.4***	0.4	0.8
# induction visits	45.2***	1.9	0.1
# care interruptions	19.4***	1.6	2.8
# group cancellations	0.2	3.2	0.3
# rescheduled visits	24.0***	32.4***	0.1
# maintenance visits	36.0***	0.5	0.1
# other encounters	139.9***	35.6***	0.5
# group visits	0.3	0.4	0.5
# no show group visits	2.0	0.7	3.2
Time since last visits (yrs) [†]	23.5***	4.7	0.0
Total time in care (yrs) ^{††}	20.3***	28.1***	2.6

[†]Time since last visit was not included as a covariate.

^{††}Total time in care was not included as a covariate.

** $p < 0.01$. *** $p < 0.001$.

Relationship between Gender and Treatment Compliance

After including covariates, there were many significant differences in treatment compliance by Gender (see Table 7). Women had more “no show” maintenance visits ($F(9, 12853) = 11.6, p = .001$) and rescheduled their visits more frequently ($F(9, 12853) = 24.0, p < .001$) than men. Women also had a statistically significant greater number of encounters ($F(9, 12853) = 35.6, p < .001$). Women were also in care longer ($F(9, 12854) = 28.1, p < .001$). There were no significant PTSD by gender interactions.

Relationship between Covariates and Treatment Compliance

There were significant relationships between all covariates and at least some measures of treatment compliance (Table 8). The race of the patient was related to induction visits ($F(9, 12853) = 8.4, p = .004$) and total time in care ($F(9, 12853) = 16.5, p < .001$). White patients had less induction visits than non-white patients. Patients in Massachusetts had poorer compliance on the majority of the variables examined. For example, patients treated in Massachusetts were more likely to not attend scheduled maintenance visits ($F(9, 12853) = 191.2, p < .001$), and had more initial ($F(9, 12853) = 48.4, p < .001$), rejoin ($F(9, 12853) = 158.5, p < .001$), and induction visits ($F(9, 12853) = 95.8, p < .001$). However, Massachusetts patients had more total time in care ($F(9, 12853) = 1880.2, p < .001$).

Age was significantly related to treatment compliance measures. As patient's age increased, the rate of "no show" visits ($F(9, 12853) = 226.2, p < .001$), rejoin visits ($F(9, 12853) = 42.8, p < .001$), rescheduled visits ($F(9, 12853) = 89.1, p < .001$) and care interruptions ($F(9, 12853) = 70.0, p < .001$) decreased. For patients, as age increased, groups visits ($F(9, 12853) = 56.8, p < .001$), encounters ($F(9, 12853) = 129.6, p < .001$), and total time in care ($F(9, 12853) = 153.4, p < .001$) increased. In regard to ethnicity, Hispanic patients were more likely to have more induction visits ($F(9, 12853) = 16.2, p < .001$) and attend maintenance visits ($F(9, 12853) = 8.7, p = .003$). Non-Hispanic patients were more likely to attend group visits ($F(9, 12853) = 26.7, p < .001$). Total time in care was significantly related to all treatment compliance measures. As the total time in care increased, so did the number of "no show" visits ($F(9, 12853) = 1873.0, p < .001$), maintenance visits ($F(9, 12853) = 42048.3, p < .001$), rejoin visits ($F(9, 12853) = 663.422, p < .001$), induction visits ($F(9, 12853) = 16.5, p < .001$), groups visits ($F(9,$

12853) = 11563.8, $p < .001$), group “no show” visits ($F(9, 12853) = 3429.0$, $p < .001$), group cancellations ($F(9, 12853) = 487.9$, $p < .001$), encounters ($F(9, 12853) = 11920.2$, $p < .001$), and time since last seen. In contrast, as total time in care increased, the number of initial visits ($F(9, 12853) = 186.0$, $p < .001$) and rescheduled visits ($F(9, 12853) = 3625.6$, $p < .001$) decreased. As the time since last seen increased, total time in care ($F(9, 12854) = 1410.9$, $p < .001$), attendance at maintenance visits ($F(9, 11566) = 47.8$, $p < .001$), and group visits ($F(9, 12853) = 574.6$, $p < .001$) decreased.

Table 7. Relationship between Covariates and Treatment Compliance.

Treatment Compliance	Race	Location	Age	Ethnicity	Care Time	Last Seen
	F	F	F	F	F	F
# no show visits	5.7	191.2***	226.3***	5.6	1873.0***	6.5
# initial visits	0.4	48.4***	0.4	2.9	186.0***	397.8***
# rejoin visits	2.6	158.5***	42.8***	3.9	663.4***	2.9
# induction visits	8.4**	95.8***	7.3**	16.2***	16.5***	59.7***
# care interruptions	0.0	172.5***	70.0***	4.1	329.0***	91.8***
# group cancellations	0.1	1.1	0.1	0.2	487.9***	5.1
# rescheduled visits	1.8	116.4***	89.1***	0.2	3625.6***	24.3***
# maintenance visits	0.8	28.0***	0.1	8.7**	42048.3**	270.4***
# other encounters	5.6	22.9***	129.7***	5.6	11920.2**	99.9***
# group visits	3.8	37.4***	56.8***	26.7***	11563.8**	574.6***
# no show group visits	0.1	29.8***	66.8***	4.3	3429.0***	69.3***
Time since last visits (yrs)	5.8	689.9***	3.7	2.5	NA	NA
Total time in care (yrs)	36.2*	1880.2**	153.4***	3.6	NA	1411.0**

** $p < .01$. *** $p < .001$

MT Adherence and Drug Use within PTSD

Medication Adherence

The relationship between PTSD, medication adherence, and drug use was evaluated using ANCOVA (Table 9). The PTSD group demonstrated greater medication adherence than the non-PTSD group. Consistent with the bivariate analyses, after controlling for covariates, patients with PTSD had a significantly greater number of positive buprenorphine screens than patients without PTSD ($F(9, 11599) = 17.7, p < .001$).

Drug Use

Although more compliant with buprenorphine, patients with PTSD had significantly more benzodiazepine use ($F(9, 11599) = 76.5, p < .001$), THC use ($F(9, 11599) = 12.8, p < .001$), amphetamine use ($F(9, 11599) = 10.7, p = .001$), cocaine use ($F(9, 11599) = 18.0, p < .001$), and opioid use ($F(9, 11599) = 17.8, p < .001$). PTSD status was unrelated to alcohol, methadone, and other drug use.

Gender

Men with PTSD used alcohol more frequently than women with PTSD ($F(9, 11599) = 21.4, p < .001$) as well as THC ($F(9, 11566) = 35.6, p < .001$). In contrast, women were more positive for benzodiazepines than men ($F(9, 11599) = 19.7, p < .001$). There were no significant PTSD by gender interactions.

Table 8. Relationship between Medication adherence/Drug Use and PTSD/Gender.

Drugs (% positive)	PTSD	Gender	PTSD X Gender
	F	F	F
Buprenorphine	17.7***	0.4	0.2
Benzodiazepine	76.5***	19.7**	0.0
THC	12.8***	35.6**	1.1
Amphetamine	10.7**	3.8	2.7
Alcohol	4.0	21.4**	0.2
Cocaine	18.0***	0.0	0.2
Opioids All	17.8***	0.1	0.1
Methadone	0.4	0.2	0.1
Other drug	2.8	1.1	1.4

** $p < .01$. *** $p < .001$

Relationship between Covariates and MT Adherence and Drug Use

Medication Adherence

There were significant relationships between co-variables and measures of medication adherence and drug use (Table 10). Compliance with buprenorphine was predicted by race ($F(9, 11599) = 44.1, p < .001$) and treatment location ($F(9, 11599) = 30.2, p < .001$). White patient buprenorphine screens were more positive than non-white patients, while screens for patients treated in Massachusetts were less often positive, suggesting less medication adherence. Non-Hispanic patients ($F(9, 11599) = 7.6, p < .006$), were more compliant with their buprenorphine than Hispanic patients. The patients that spent more total time in care ($F(9, 11599) = 861.5, p < .001$) had more positive buprenorphine screens. As patients' time since last seen ($F(9, 11566) = 296.4, p < .001$) increased, their percentage of buprenorphine decreased.

Drug Use

Patients in Massachusetts used alcohol ($F(9, 11566) = 47.8, p < .001$), THC ($F(9, 11599) = 64.7, p < .001$), cocaine ($F(9, 11566) = 123.1, p < .001$), and opioids ($F(9, 11566) = 30.1, p < .001$) more frequently than patients in other states. Patient race was not related to benzodiazepines, alcohol, methadone, and other drugs, but White patients were less likely to use THC ($F(9, 11566) = 12.4, p < .001$), cocaine ($F(9, 11567) = 50.2, p < .001$), and opioids ($F(9, 11599) = 40.3, p < .001$). In contrast, White patients used amphetamines ($F(9, 11566) = 20.0, p < .001$) more frequently. Although Hispanic patients were less likely to use benzodiazepines ($F(9, 11567) = 21.0, p < .001$), alcohol ($F(9, 12853) = 8.2, p = .004$) and amphetamines ($F(9, 11566) = 27.4, p < .001$), Hispanic patients were more likely to use THC ($F(9, 11566) = 5.2, p = .022$), cocaine ($F(9, 11567) = 13.1, p = .001$) and opioids ($F(9, 11599) = 16.2, p < .001$).

Age was significantly related to all medication adherence and drug use. As patient's age increased, the percent positive for screens of alcohol ($F(9, 11562) = 52.6, p < .001$) benzodiazepines ($F(9, 11567) = 106.6, p < .001$), and methadone ($F(9, 11582) = 18.5, p < .001$) increased. As the age of the patient increased, the percent positive screen of opioids ($F(9, 11599) = 41.5, p < .001$) decreased. Total time in care was related significantly to medication adherence ($F(9, 11599) = 861.5, p < .001$) with an increase in buprenorphine use. As patients spent more time in care, the positive percent of buprenorphine increased. As the total time in care increased, alcohol ($F(9, 11567) = 16.8, p < .001$), cocaine ($F(9, 11567) = 374.5, p < .001$), methadone ($F(9, 11582) = 84.1, p < .001$), opioids ($F(9, 11567) = 1065.2, p < .001$), other drugs ($F(9, 2441) = 4.1, p < .027$) all decreased in positive screens. As total time in care increased, amphetamines ($F(9, 11566) = 11.7, p = .001$) and THC ($F(9, 11566) = 4.5, p < .034$) increased in

positive screens. Time since last seen was significantly related to all medication adherence and some drug measures. As the time since last seen increased, positive buprenorphine ($F(9, 11599) = 296.4, p < .001$) screens decreased. As time since last seen increased, the use of benzodiazepines ($F(9, 11567) = 64.3, p < .001$), alcohol ($F(9, 11562) = 9.126, p < .003$), methadone ($F(9, 11582) = 19.5, p < .001$), and opioids ($F(9, 11599) = 407.9, p < .001$) all increased.

Table 9. Relationship between Medication adherence/Drug Use results and covariates

Drugs (% positive)	Race	Location	Age	Ethnicity	Care Time	Last Seen
	F	F	F	F	F	F
Buprenorphine	44.1***	30.2***	3.4	7.6**	861.5***	296.4***
Benzodiazepine	4.8	0.5	106.6***	20.9***	0.2	64.3***
Alcohol	0.3	47.8***	52.6***	8.2**	16.8***	9.1**
THC	12.3***	64.7***	367.0***	5.2*	4.5	0.0
Amphetamine	20.0***	56.2***	3.3	27.4***	11.7**	3.3
Cocaine	50.2***	123.1***	3.5	13.1***	374.5***	1.4
Methadone	0.5	0.6	18.5***	3.6	84.1***	19.5***
Other drug	2.3	740.4***	0.6	0.1	4.9	0.5
Opioids All	40.3***	30.1***	41.5***	16.2***	1065.2***	408.0***

** $p < .01$. *** $p < .001$

Summary of PTSD Results

Patients with a history of PTSD spent more time in care and attended more individual and group visits. These patients had difficulty attending their scheduled meetings, had more initial visits as well as induction visits, and had a larger total number of other encounters. While these patients utilized opioids, benzodiazepines, and THC more than those without PTSD, they were also more compliant with their medication adherence in the form of buprenorphine.

**AIM 2 – To compare outcomes of Medication treatment (MT) success in patients
with elevated and patients without PTS.**

Relationship between Trauma and Treatment Compliance

After including covariates, there were many significant differences in treatment compliance by trauma history. Individuals with a history of trauma had more “no shows” for maintenance visits ($F(9, 12853) = 116.6, p < .001$) than individuals without a history of trauma, but there was no difference in frequency of “no shows” in group visits ($F(9, 12853) = 2.0, p = 0.157$). Individuals with trauma had more initial visits ($F(9, 12853) = 33.7, p < .001$), rejoin visits ($F(9, 12853) = 57.6, p < .001$), inductions ($F(9, 12853) = 106.1, p < .001$), and care interruptions ($F(9, 12853) = 8.3, p = .004$) than individuals without a history of trauma. Those with a history of trauma also rescheduled their maintenance visits more frequently ($F(9, 12853) = 47.5, p < .001$). There is evidence that individuals with trauma had poorer treatment compliance outcomes than individuals without a history of trauma (see Table 11).

Analyses not consistent with poorer treatment compliance include individuals with a history of trauma had more maintenance visits ($F(9, 12853) = 132.0, p < .001$) more other encounters ($F(9, 12853) = 265.3, p = .000$), total time in care ($F(9, 12853) = 420.8, p < .001$), and had been seen more recently ($F(9, 12853) = 274.7, p < .001$).

Gender and Treatment Compliance

After including covariates, there were significant differences in treatment compliance by gender. Women had more “no show” visits for individual maintenance visits ($F(9, 12853) = 50.2, p < .001$) and group visits ($F(9, 12853) = 9.3, p = .002$) than men. In addition, women rescheduled more than men ($F(9, 12853) = 91.0, p < .001$) had

more total overall encounters ($F(9, 12853) = 117.1, p < .001$) and were in care longer than men ($F(9, 12854) = 24.2, p < .001$).

Table 10. Relationship between Trauma, Gender, and Treatment Compliance.

Treatment Compliance	Trauma	Gender	Trauma X Gender
	F	F	F
# no show visits	116.6***	50.2***	31.4***
# initial visits	33.7***	2.7	1.0
# rejoin visits	57.6***	1.3	0.2
# induction visits	106.1***	2.3	0.0
# care interruptions	8.3**	3.9	1.1
# group cancellations	0.6	4.5	0.7
# rescheduled visits	47.5***	91.1***	17.2***
# maintenance visits	132.0***	0.4	0.4
# other encounters	265.3***	117.1***	46.8***
# group visits	0.1	1.9	3.5
# no show group visits	2.0	9.3**	0.5
Time since last visits (yrs)	274.7***	2.8	0.1
Total time in care (yrs)	420.8***	24.3***	4.1

** $p < .01$. *** $p < .001$

When examining the impact gender on the relationship between trauma and treatment compliance, three significant interactions were identified (see Table X). There was a significant interaction between trauma and gender and the number of “no show” visits ($F(9, 12853) = 31.4, p < .001$). For individuals without trauma, there was not a difference in “no show” visits by gender. In contrast, among those with PTSD, women had a higher number of “no show” visits than men (see Figure 3).

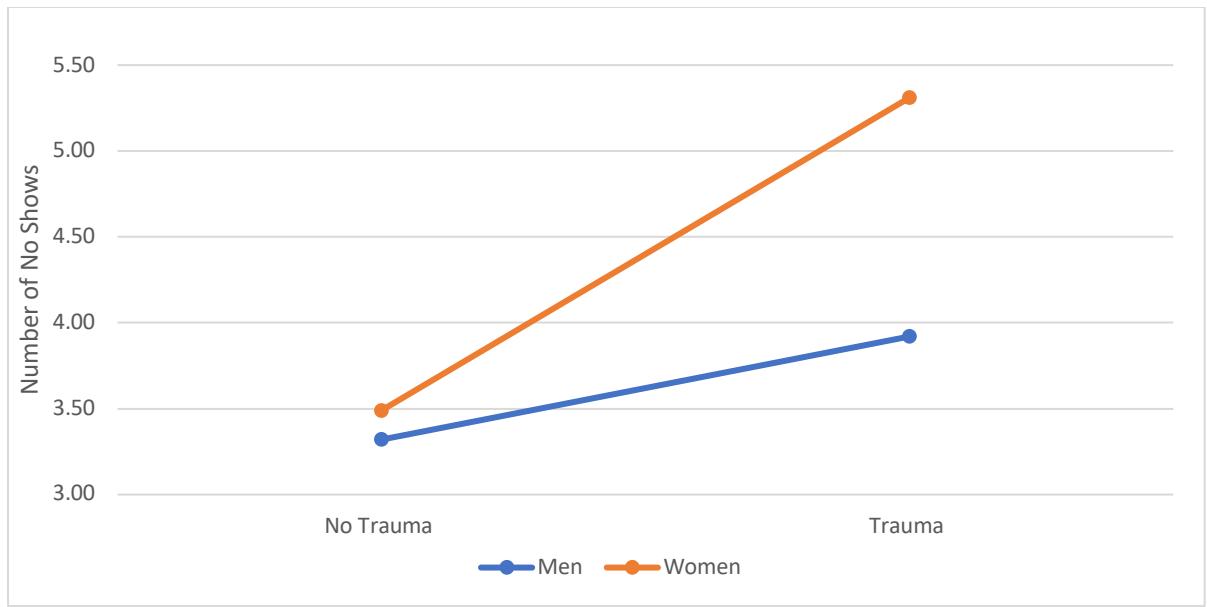


Figure 3. Trauma X Gender Interaction within “No Show” Visits.

There was also a significant interaction between trauma and gender on the number of rescheduled visits ($F(9, 12853) = 17.2, p < .001$). Similar to the number of “no show” visits, men had a comparable number of rescheduled visits regardless of PTSD status. Women with PTSD had more rescheduled visits than women without PTSD (see Figure 4).

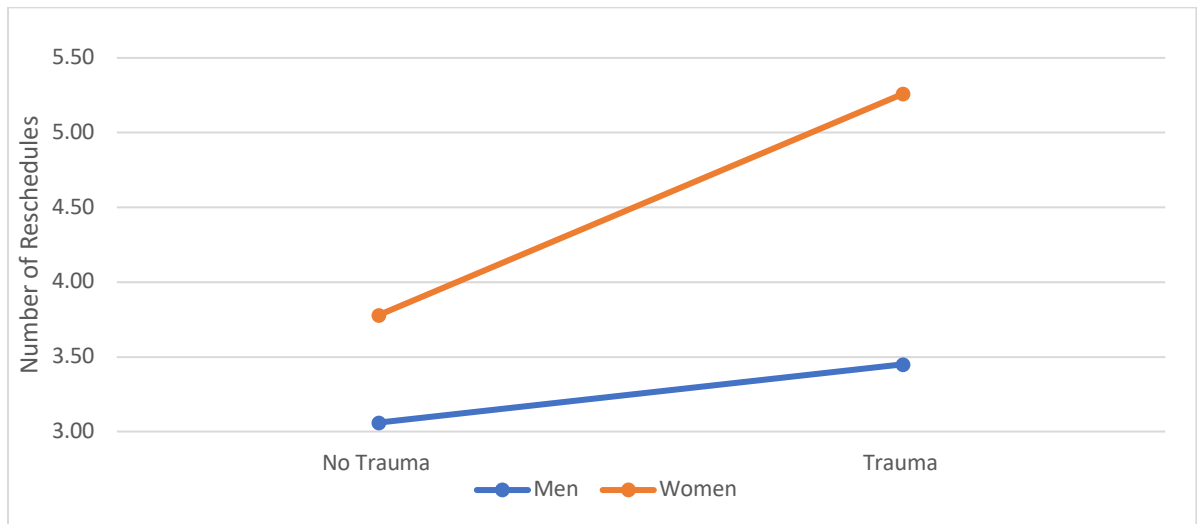


Figure 4. Trauma X Gender Interaction within Rescheduled Visits.

Finally, there was a significant interaction between trauma and gender and the number of total number of encounters ($F(9, 12853) = 46.8, p < .001$). Men and women without a history of trauma had a similar number of encounters. For those with a trauma history, women had more overall encounters than men (see Figure 5).

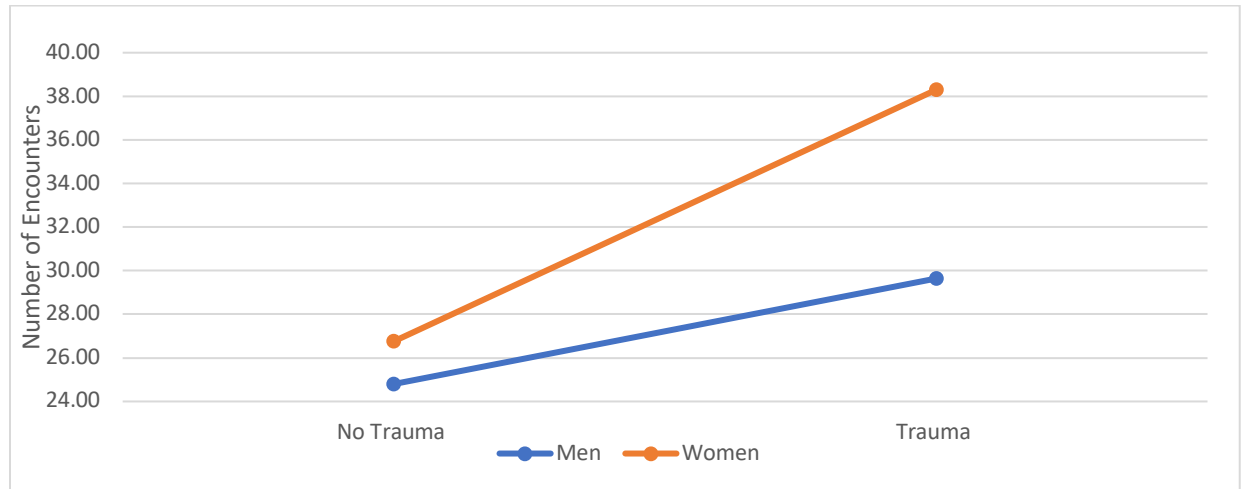


Figure 5. Trauma X Gender Interaction and Number of Encounters.

Relationship between Covariates and Treatment Compliance

There were significant relationships between covariates and several measures of treatment compliance (Table 12). All relationships between compliance measures and treatment state were significant with the exception of group cancellations visits. Patients in Massachusetts had poorer compliance on the majority of the variables examined. For example, patients treated in Massachusetts were more likely to not attend scheduled maintenance visits ($F(9, 12853) = 222.7, p < .001$), and had more rejoin visits ($F(9, 12853) = 181.1, p < .001$), and induction visits ($F(9, 12853) = 113.8, p < .001$). However, Massachusetts patients had more total time in care ($F(9, 12853) = 1936.0, p < .001$) and more encounters ($F(9, 12853) = 41.5, p < .001$). Patient race was unrelated to all covariates except induction visits ($F(9, 12853) = 8.5, p = .004$) and total time in care

($F(9, 12853) = 34.6, p < .001$). Non-whites were more likely to have more induction visits and less total time in care. Hispanic patients were significantly less likely to have “no show” maintenance visits ($F(9, 12853) = 6.8, p = .009$), attended more group visits ($F(9, 12853) = 26.7, p < .001$), and had more induction visits ($F(9, 12853) = 18.6, p < .001$). Hispanic patients also had a significantly higher rate of maintenance visits ($F(9, 12853) = 10.3, p = .001$).

Age was significantly related to compliance measures such as attending “no shows” to maintenance visits ($F(9, 12853) = 231.5, p < .001$), rejoin visits $F(9, 12854) = 43.561, p < .001$), encounters $F(9, 12853) = 135.0, p < .001$), and total time in care $F(9, 12853) = 142.7, p < .001$). With the exception of induction visits, total time in care was significantly related to all treatment compliance measures. As the total time in care increased, the number of no shows ($F(9, 12853) = 1674.6, p < .001$), maintenance visits ($F(9, 12853) = 40303.6, p < .001$), rejoin visits ($F(9, 12853) = 590.4, p < .001$), induction visits ($F(9, 12853) = 49.9, p < .001$), groups visits ($F(9, 12853) = 11208.0, p < .001$), group no shows ($F(9, 12853) = 3292.1, p < .001$), group cancels ($F(9, 12853) = 466.8, p < .001$), encounters ($F(9, 12853) = 11144.5, p < .001$), and time since last seen ($F(9, 12853) = 1227.5, p < .001$) all increased. The number of initial visits ($F(9, 12853) = 197.9, p < .001$) and rescheduled visits ($F(9, 12853) = 3384.2, p < .001$), decreased with the more time spent in care. As the time since patients were last seen increased the total time in care ($F(9, 12854) = 1227.5, p < .001$), maintenance visits $F(9, 12853) = 246.0, p < .001$) and group visits $F(9, 12853) = 570.2, p < .001$) all decreased.

Table 11. Relationship between Treatment Compliance and Covariates.

Treatment Compliance	Race	Location	Age	Ethnicity	Care Time	Last Seen
	F	F	F	F	F	F

# no show visits	5.8	222.7***	231.5***	6.8**	1674.3***	3.3
# initial visits	0.4	60.6***	0.4	3.7	197.9***	385.0***
# rejoin visits	2.5	181.8***	43.6***	4.9	590.4***	4.5
# induction visits	8.5**	113.8***	7.8**	18.4***	5.8	49.9***
# care interruptions	0.0	186.2***	70.4***	4.6	306.2***	93.6***
# group cancellations	0.1	1.3	0.2	0.2	466.8***	5.3
# rescheduled visits	1.9	132.7***	90.5***	0.1	3384.2***	20.0***
# maintenance visits	0.8	38.1***	0.0	10.3**	40303.6***	246.0***
# other encounters	5.7	41.5***	135.0***	4.0	11144.5***	80.8***
# group visits	3.8	36.9***	56.6***	26.7***	11208.0***	570.2***
# no show group visits	0.1	31.4***	66.7***	4.1	3292.1***	67.5***
Time since last visit (yrs)	6.6	694.1***	2.1	3.6	NA	NA
Total time in care (yrs)	34.6***	1936.0***	142.7***	2.4	NA	1227.5***

p<.01. *p<.001

Relationship between Trauma, MT Adherence, and Drug Use

Trauma, medication adherence, and drug use were evaluated using ANCOVA (table 13). The trauma group demonstrated greater medication adherence than the non-trauma group. Consistent with the bivariate analyses, after controlling for covariates, patients with a history of trauma had a significantly greater number of buprenorphine positive screens than patients without a history of trauma ($F(9, 12853) = 24.3, p < .001$).

Drug Use

Although more compliant with their medication, those with a trauma history demonstrated significantly increased use of benzodiazepines ($F(9, 12853) = 21.3, p < .001$), amphetamines ($F(9, 12853) = 18.1, p < .001$) and cocaine ($F(9, 12853) = 18.5, p < .001$). Unlike the PTSD group, the trauma and non-trauma group did not demonstrate a significant difference in their use of opioids ($F(9, 12853) = 2.0, p = .165$).

Gender

Men had higher rates of drug use for the majority of the drugs tested. Men used more alcohol ($F(9, 12853) = 18.096, p < .001$), other drugs ($F(9, 12853) = 4.107, p = .043$), THC ($F(9, 11566) = 54.9, p < .001$), and amphetamines ($F(9, 11566) = 14.9, p < .001$) than women. In contrast, women used benzodiazepines significantly more than men ($F(9, 11599) = 19.7, p = .000$). There were no trauma by gender interactions related to medication adherence or drug use.

Table 12. Relationship between Trauma, Gender, Medication adherence and Drug Use.

Drug (% Positive)	Trauma	Gender	Trauma X Gender
	F	F	F
Buprenorphine	24.3***	0.4	0.3
Benzodiazepine	21.3***	23.6***	0.5
Alcohol	0.2	18.1***	1.1
THC	1.7	54.9***	0.0
Amphetamine	18.1***	14.9***	0.3
Cocaine	18.5***	0.4	2.0
Methadone	0.3	0.1	0.4
Other drug	2.9	4.1	0.4
Opioids All	1.9	1.1	0.1

** $p < .01$. *** $p < .001$

Relationship between Covariates and MT Adherence and Drug Use

Medication adherence

There were significant relationships between covariates and measures of medication adherence and drug use (Table 14). Medication adherence was related to race ($F(9, 11599) = 44.2, p < .001$) with whites being more compliant, and treatment

location ($F(9, 11599) = 25.0, p < .001$) with those in Massachusetts less compliant. In regard to ethnicity ($F(9, 11599) = 6.9, p = .009$), non-Hispanics were significantly more compliant. Age ($F(9, 11599) = 3.3, p = .070$) was not related to an increase in buprenorphine use. Spending more time in care ($F(9, 11599) = 798.1, p < .001$) was related to an increase in buprenorphine use. A decrease in the time since last seen ($F(9, 11599) = 284.3, p < .001$) were significantly related to increased buprenorphine use.

Drug Use

Patients in Massachusetts used more alcohol ($F(9, 11562) = 46.3, p < .001$), THC ($F(9, 11566) = 70.6, p < .001$), cocaine ($F(9, 11567) = 136.1, p < .001$), and opioids ($F(9, 11599) = 26.2, p < .001$) more frequently than patients treated in other states. White patients were less likely to use THC ($F(9, 11566) = 12.2, p < .001$), cocaine ($F(9, 11567) = 50.1, p < .001$), and opioids ($F(9, 11599) = 40.5, p < .001$), but used amphetamines ($F(9, 11566) = 20.0, p < .001$) more frequently. Hispanic patients were significantly less likely to use benzodiazepines ($F(9, 11567) = 19.1, p < .001$), alcohol ($F(9, 11562) = 8.3, p = .004$), and amphetamines ($F(9, 11566) = 26.4, p < .001$). However, Hispanic patients were more likely to use THC ($F(9, 11566) = 5.6, p = .018$), cocaine ($F(9, 11567) = 14.0, p < .001$), and opioids ($F(9, 11599) = 16.2, p < .001$).

Age was significantly related to medication adherence and most drug measures except amphetamine ($F(9, 11566) = 3.4, p = .065$), cocaine ($F(9, 11567) = 3.7, p = .056$) and other drugs ($F(9, 11567) = 0.5, p = .474$). With the exception of benzodiazepines and amphetamines, an increase in total time care resulted in a decrease in alcohol $F(9, 11562) = 17.6, p < .001$, cocaine $F(9, 11567) = 390.0, p < .001$, methadone $F(9, 11582) = 80.8, p < .001$, other drugs $F(9, 11599) = 6.2, p = .013$, and opioids $F(9, 11599) = 1025.6, p < .001$). The time since last seen was significantly related to

medication adherence and some drug use variables. As the time since last seen increased, patients decreased their use of buprenorphine ($F(9, 11582) = 284.3, p < .001$). As the time since last seen increased, the percent of positive screens of benzodiazepine $F(9, 11567) = 67.7, p < .001$, alcohol $F(9, 11562) = 9.4, p < .001$, methadone $F(9, 11582) = 19.4, p < .001$, and opioids $F(9, 11599) = 402.8, p < .001$ all increased.

Table 13. Relationship between Medication adherence, Drug Use, and Covariates.

Drug (% Positive)	Race	Location	Age	Ethnicity	Care Time	Last Seen
	F	F	F	F	F	F
Buprenorphine	44.2***	25.0***	3.3	6.9**	798.1***	284.3***
Benzodiazepine	5.0	0.0	105.9***	19.1***	0.0	67.7***
Alcohol	0.3	46.3***	52.4***	8.3**	17.6***	9.4**
THC	12.2***	70.6***	366.7***	5.6*	3.9*	0.0
Amphetamine	19.9***	50.4***	3.4	26.4***	7.3**	2.4
Cocaine	50.1***	136.2***	3.7	14.0***	390.0***	2.1
Methadone	0.5	0.5	18.5***	3.5	80.8***	19.1***
Other drug	2.3	726.5***	0.5	0.2	6.2*	0.4
Opioids	40.5***	26.2***	41.5***	15.5***	1025.6***	402.8***

** $p < .01$ *** $p < .001$

AIM 3 – To compare outcomes of Medication treatment (MT) success in patients with an involvement in the Criminal Justice System (CJS) and patients without involvement in the CJS.

Relationship between CJS and Treatment Compliance

After including covariates, there were many significant differences in treatment compliance by CJS. Individuals with CJS had more “no shows” for maintenance visits ($F(9, 12914) = 373.107, p < .001$) than individuals without CJS. Similarly, those with CJS had more “no show” group visits ($F(9, 12914) = 24.720, p < 0.001$). Individuals with

CJS had more initial visits, rejoin visits, inductions, and care interruptions ($F(9, 12914) = 160.953, p < .001$), ($F(9, 12914) = 341.315, p < .001$), ($F(9, 12914) = 307.428, p < .001$), ($F(9, 12914) = 182.335, p < .001$), respectively, than individuals without CJS. There is evidence that individuals with CJS have more care interruptions than individuals without CJS suggesting poorer treatment outcomes (see Table 15).

Although there were no differences in the frequency in cancelling group visits, individuals with CJS did reschedule their visits more frequently ($F(9, 12914) = 118.164, p < .001$). Individuals with a CJS also had more overall maintenance visits ($F(9, 12914) = 210.4, p < .001$) and total other encounters ($F(9, 12914) = 493.6, p < .001$). Thus, even after controlling for the amount of time in care and the time since the last visit, staff are interacting with patients with a CJS more than individuals without CJS. Finally, there was also a significant relationship between CJS and total time in care ($F(8, 12914) = 743.5, p < .001$) and the time since the last visit ($F(7, 13445) = 146.2, p < .001$).

Relationship between Gender and Treatment Compliance

After including covariates, there were many significant differences in treatment compliance by Gender (Table 15). Women had more “no show” maintenance visits ($F(9, 12914) = 48.5, p < .001$), rescheduled visits ($F(9, 12914) = 104.6, p < .001$), and had more group cancellations ($F(9, 12914) = 10.6, p = .009$) than men. Women had more encounters ($F(9, 12914) = 136.7, p < .001$) and were less likely to have interruptions in care ($F(9, 12914) = 13.0, p < .001$).

Table 14. Relationship between CJS, Gender, and Treatment Compliance.

Treatment Compliance	CJS	Gender	CJS X Gender
	F	F	F
# no show visits	373.1***	48.5***	7.9**
# maintenance visits	210.4***	3.4	0.0
# initial visits	161.0***	0.0	0.7
# rejoin visits	341.3***	1.7	3.2
# induction visits	307.4***	1.3	2.6
# group visits	1.7	0.1	0.5
# no show group visits	24.7***	9.7**	0.5
# group cancellations	1.7	10.6**	5.9
# rescheduled visits	118.1***	104.6***	4.0
# other encounters	493.6***	136.7***	16.1***
Time since last visits (yrs)	146.2***	10.2**	0.6
# care interruptions	182.3***	13.0***	3.5
Total time in care (yrs)	743.5***	68.7***	6.6

p<.01. *p<.001

There were two significant CJS by gender interactions: the number of “no show” visits and total encounters. There was a difference in the relationship between CJS stats and frequency of no show maintenance visit between men and women ($F(9, 12914) = 8.0, p = .005$)(Figure 6). There was a larger difference between men and women in the number of no show visits for those with a history of involvement in CJS than for those without a history of CJS involvement. These data suggest that gender moderates the relationship between CJS and number of no shows.

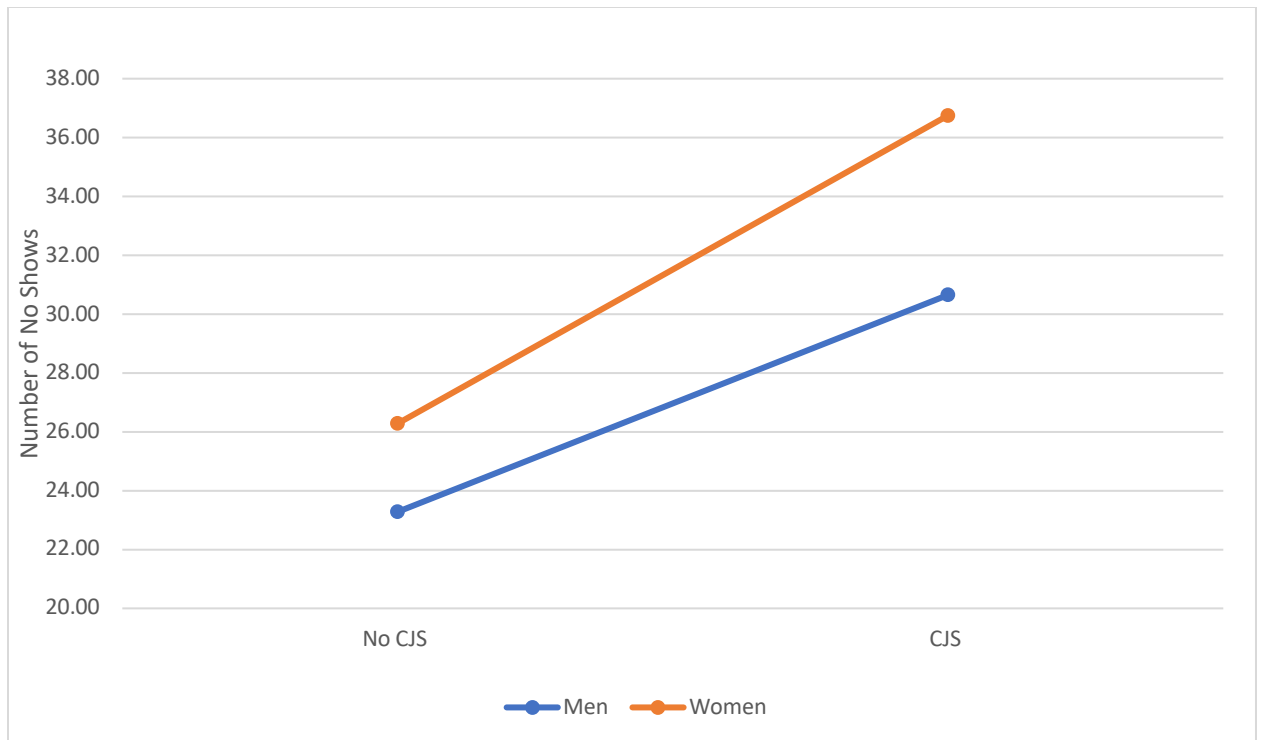


Figure 6. Number of “No Shows” within CJS x Gender Interaction

There was a difference in the number of encounters based on CJS history and gender ($F(9, 12914) = 16.1, p < .001$). There was a larger difference between men and women in the number overall encounters for those with a history of involvement in CJS than for those without a history of CJS involvement (Figure 7). These data suggest that gender moderates the relationship between CJS and number of encounters.

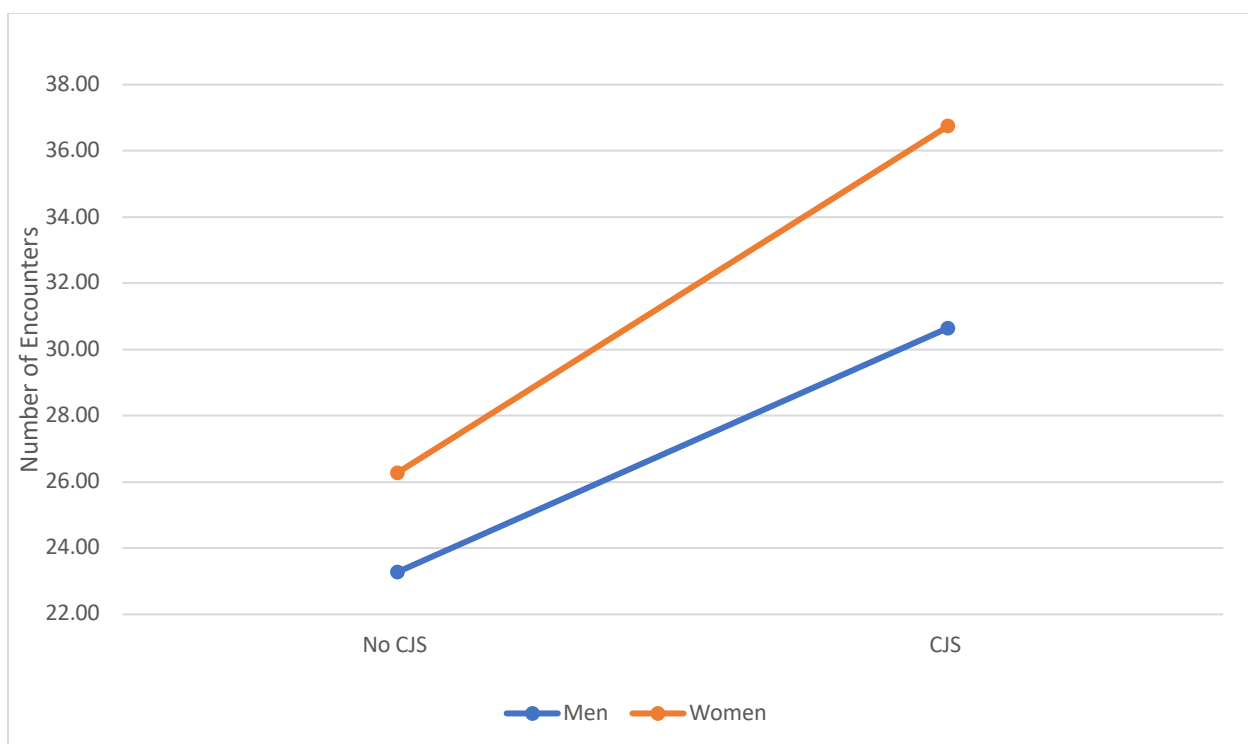


Figure 7. Number of Encounters within CJS x Gender Interaction

Relationship between Covariates and Treatment Compliance

There were significant relationships between covariates and several measures of treatment compliance (Table 16). All relationships between compliance measures and treatment state were significant with the exception of group cancellations visits. Patients treated in Massachusetts had poorer compliance on the majority of the variables examined. For example, patients treated in Massachusetts were more likely to not attend scheduled maintenance visits ($F(9, 12853) = 226.3, p < .001$), had more rejoin visits ($F(9, 12914) = 190.8, p < .001$), induction visits ($F(9, 12853) = 119.2, p < .001$), and more encounters ($F(9, 12914) = 40.4, p < .001$). However, Massachusetts patients had more total time in care ($F(9, 12915) = 1899.0, p < .001$).

Patient race was related to the number of “no show” visits ($F(9, 12914) = 7.2, p = .007$), induction visits ($F(9, 12914) = 9.5, p = .002$), encounters ($F(9, 12915) = 7.1, p =$

.00) and total time in care ($F(9, 12915) = 30.3, p < .001$). Non-whites were more likely to have more induction visits ($F(9, 12915) = 9.5, p = .002$) and less total time in care ($F(9, 12915) = 30.3, p < .001$). Hispanic patients attended more group visits ($F(9, 12914) = 26.9, p < .001$) and had more induction visits ($F(9, 12914) = 17.0, p < .001$). Hispanic patients also had a significantly higher rate of maintenance visits ($F(9, 12914) = 9.6, p = .002$).

Age was significantly related to treatment compliance measures. As age increased, the number of “no shows” to maintenance visits ($F(9, 12914) = 57.8, p < .001$) and the number of rejoin visits ($F(9, 12914) = 22.0, p < .001$), encounters ($F(9, 12914) = 86.2, p < .001$), rescheduled visits ($F(9, 12914) = 69.4, p < .001$) and interruptions in care ($F(9, 12914) = 49.1, p < .001$) decreased. As age increased, the total time in care ($F(9, 12914) = 215.351, p < .001$) increased.

With the exception of induction visits, the total time in care was significantly related to all treatment compliance measures. As the total time in care increased, the number of no show visits ($F(9, 12914) = 1503.3, p < .001$), rejoin visits ($F(9, 12914) = 465.3, p < .001$), group no shows ($F(9, 12914) = 3157.9, p < .001$), group cancellations ($F(9, 12914) = 455.1, p < .001$), rescheduling ($F(9, 12914) = 3232.0, p < .001$), encounters ($F(9, 12914) = 10743.0, p < .001$), and interruptions ($F(9, 12914) = 266.6, p < .001$) increased. However, maintenance visits ($F(9, 12914) = 39510.2, p < .001$) and groups visits ($F(9, 12914) = 11008.4, p < .001$) increased as well as total time in care increased. As total time in care increased, the number of initial visits ($F(9, 12914) = 245.6, p < .001$) and the time since last seen ($F(9, 12914) = 1262.4, p < .001$) decreased. As the time since last seen increased, the total time in care increases ($F(9, 12915) =$

1262.4, $p < .001$), while attending maintenance ($F(9, 12914) = 263.5, p < .001$) and group visits ($F(9, 12914) = 570.0, p < .001$) decreased.

Table 15. Relationship between Treatment Compliance and Covariates.

Treatment Compliance	Race	Location	Age	Ethnicity	Care Time	Last Seen
	F	F	F	F	F	F
# no show visits	7.2**	226.4***	174.9***	6.6	1503.3***	4.4
# maintenance visits	1.1	38.2***	2.8	9.6**	39510.2***	263.5***
# initial visits	0.3	66.1***	3.2	3.8	245.6***	385.3***
# rejoin visits	3.4	190.8***	21.9***	4.6	465.6***	4.9
# induction visits	9.5**	119.2***	0.9	17.0***	0.1	53.9***
# group visits	3.7	38.2***	57.9***	26.9***	11008.4***	570.0***
# no show group visits	0.2	32.0***	57.8***	4.2	3157.9***	67.1***
# group cancellations	0.1	1.2	0.1	0.2	455.1***	5.0
# rescheduled visits	2.2	131.5***	69.4***	0.1	3232.0***	22.2***
# other encounters	7.1**	40.4***	86.2***	4.6	10742.9***	93.5***
Time since last visit (yrs)	7.5	727.3***	7.5	2.9	NA	NA
# care interruptions	0.0	194.6***	49.1***	4.5	226.6***	103.5***
Total time in care (yrs)	30.3***	1899.0***	215.5***	3.0	NA	1262.4***

** $p < .01$. *** $p < .001$

Medication Adherence and Drug Use within CJS

Medication Adherence

CJS, medication adherence, and drug use were evaluated using ANCOVA (Table 17). The CJS group demonstrated greater medication adherence than the non-CJS group. Consistent with bivariate analyses, after controlling for covariates, patients CJS had a significantly greater number of positive buprenorphine screens than patients without CJS ($F(9, 11599) = 62.7, p < .001$).

Drug Use

Although more compliant with their medication, patients with CJS had significantly more benzodiazepine use ($F(9, 11567) = 43.4, p < .001$), cocaine use ($F(9, 11567) = 34.3, p < .001$) and other drug use ($F(9, 2441) = 4.9, p = .028$). Those with CJS status used methadone ($F(9, 11582) = 7.0, p = .008$) and opioids ($F(9, 11599) = 28.9, p < .001$) less than those without CJS. CJS status was unrelated to THC, alcohol, and amphetamines,

Gender

There were several significant differences in drug use variables by gender. Men used significantly more THC ($F(9, 11566) = 85.7, p = .000$), alcohol ($F(9, 11562) = 37.3, p < .001$) and other drugs ($F(9, 2441) = 4.0, p = .045$) than women, but women used more amphetamines than men ($F(9, 11566) = 21.1, p < .001$). There were no significant CJS by gender interactions.

Table 16. Relationship between Medication adherence/Drug Use and CJS and Gender.

Drugs (% Positive)	CJS	Gender	CJS X Gender
	F	F	F
Buprenorphine	62.7***	3.7	0.1
Benzodiazepine	1.0	43.4***	1.2
Alcohol	0.0	37.3***	0.0
THC	6.4	85.7***	0.1
Amphetamine	2.8	21.1***	0.2
Cocaine	34.3***	0.0	0.9
Methadone	6.9	0.2	2.6
Other drug	4.9	4.0	1.5
Opioids All	28.9***	2.1	0.0

p<.01. *p<.001

Relationship between Covariates, MT adherence, and Drug Use

Medication Adherence

There were significant relationships between co-variables and measures of medication adherence and drug use (Table 18). Medication adherence was related to race ($F(9, 11599) = 43.1, p < .001$) and treatment location ($F(9, 11599) = 24.1, p < .001$). Non-white and those treatment in Massachusetts were less compliant, while Hispanics were more compliant ($F(9, 11599) = 7.1, p = .008$). As Age ($F(9, 11599) = 7.3, p = .007$) and total time in care ($F(9, 11599) = 738.2, p < .001$) increases, the percentage of buprenorphine also increases. As the time since last seen ($F(9, 12914) = 296.0, p < .001$) increased, the use of buprenorphine decreased.

Drug Use

Patients treated in Massachusetts use significantly more alcohol ($F(9, 11562) = 45.8, p < .001$), THC ($F(9, 11566) = 68.2, p < .001$), cocaine ($F(9, 11567) = 136.4, p < .001$), amphetamine ($F(9, 11566) = 52.4, p < .001$) and opioids ($F(9, 11599) = 24.9, p < .001$) than patients treated in other states. White patients were less likely to use THC ($F(9, 11566) = 11.9, p = .001$), cocaine ($F(9, 11567) = 51.0, p < .001$), and opioids ($F(9, 11599) = 39.7, p < .001$), but used amphetamines ($F(9, 11566) = 19.9, p < .001$) more frequently than non-white patients. Hispanic patients were significantly less likely to use benzodiazepines ($F(9, 11567) = 19.1, p < .001$), alcohol ($F(9, 11562) = 8.3, p = .004$), and amphetamines ($F(9, 11566) = 26.4, p < .001$). Hispanic patients had a significantly higher use of cocaine ($F(9, 11567) = 14.0, p < .001$), and opioids ($F(9, 11599) = 16.2, p < .001$). Methadone, THC, and other drugs did not have a significant relationship with ethnicity.

Age was significantly related to medication adherence and most drug measures. Amphetamines ($F(9, 11566) = 2.6, p = .111$), cocaine ($F(9, 11567) = 1.5, p = .223$) and other drugs ($F(9, 11567) = .4, p = .552$) did not have a significant relationship to age. With the exception of benzodiazepines and other drugs, as total time in care increased, alcohol ($F(9, 11562) = 16.6, p < .001$), cocaine ($F(9, 11562) = 403.6, p < .001$), methadone ($F(9, 11582) = 70.6, p < .001$) and opioids ($F(9, 11599) = 954.0, p < .001$) all decreased in positive screens. The time since last seen was significantly related to a decrease in medication adherence. As the time since last seen increased ($F(9, 11562) = 16.6, p < .001$) the percent positive of buprenorphine decreased. As time since last seen increased, the percent positive screen of benzodiazepines ($F(9, 11567) = 62.9, p < .001$), alcohol ($F(9, 11562) = 9.2, p = .002$), methadone ($F(9, 11582) = 19.1, p < .001$), and opioids ($F(9, 11599) = 407.8, p < .001$) increased.

Table 17. Relationship between Medication adherence/Drug Use and Co-variates

Drugs (% Positive)	Race	Location	Age	Ethnicity	Care Time	Last Seen
	F	F	F	F	F	F
Buprenorphine	43.1***	24.1***	7.3**	7.1	738.2***	296.0***
Benzodiazepin	5.0	0.0	108.3***	19.7***	0.1	62.9***
Alcohol	0.3	45.8***	52.1***	8.3**	16.6***	9.2**
THC	11.9**	68.2***	372.3***	5.4	7.3**	0.0
Amphetamine	19.9***	52.4***	2.5	26.9***	9.2**	3.4
Cocaine	51.0***	136.4***	1.5	13.7***	403.6***	1.4
Methadone	0.5	0.4	15.8***	3.5	70.6***	19.1***
Other drug	2.3	736.7***	0.3	0.2	6.3	0.6
Opioids All	39.7***	24.9***	49.0***	15.5***	954.0***	407.8***

p<.01. *p<.001

Summary of CJS Results

Patients with CJS status are spending more time in care, having more contact with care providers, and attending more individual maintenance visits. These patients also had more difficulty attending their scheduled meetings, required more initial and inductions visits, had more rejoin visits, more encounters, and rescheduled more often than those without CJS. Patients with a positive CJS status also complied more with medication treatment utilizing their prescribed buprenorphine more successfully than those without CJS. This group also used opioids less than the non-CJS group but used more benzodiazepines and cocaine.

Aim 4. To examine if PTS status moderates the relationship between involvement in the CJS and Medication Treatment success.

To examine whether or not the interaction of PTSD or Trauma would moderate the relationship between involvement in the criminal justice system (CJS) and treatment success, a series of ANCOVA's were completed. In these analyses, the impact of PTSD or Trauma, CJS, and the interaction term were examined. Gender was also included as a between-subjects variable and included in the interactions examined. In addition to a discussion about significant interactions identified, only relationships between PTSD, trauma, or CJS and treatment compliance not already presented will be discussed below. For Aim 3 interactions, the traditional level of significance was used ($\alpha = 0.05$).

Treatment Compliance

When evaluating the main effects of PTSD and CJS on treatment compliance in the analyses exploring potential interactions, all main effects were identical to analyses presented for Aims 1 and Aim 2. Analyses also identified several significant PTSD X

CJS interactions. The relationships in CJS groups were different for the levels of PTSD status for the number of initial visits, the number of induction visits, and time since the last visit (See Table 19).

Table 18. Relationship between Treatment Compliance and PTSD, CJS, and Gender.

Treatment Compliance	PTSD	CJS	PTSD X CJS	PTSD X Gender X CJS
	F	F	F	F
# no show visits	27.2***	158.4***	0.1	0.2
# maintenance visits	20.1***	82.0***	0.8	1.1
# initial visits	36.5***	21.8***	26.3***	1.8
# rejoin visits	41.4***	150.4***	0.0	0.3
# induction visits	15.0***	78.7***	16.7***	3.2
# group visits	1.5	0.1	2.8	1.0
# no show group visits	1.5	14.9***	0.4	0.5
# group cancellations	0.8	3.1	1.8	1.2
# rescheduled visits	19.1***	66.7***	1.5	1.3
# other encounters	112.6***	255.4***	3.1	0.7
Time since last visit (yrs)	8.1**	36.5***	6.4**	1.6
# care interruptions	11.4**	77.7***	0.0	0.5
Total time in care (yrs)	6.0*	306.7***	0.3	0.6

*p<.05 **p<.01 ***p<.001

When examining for a potential moderating effect of PTSD on the relationship between CJS and the number of initial visits, there was a significant interaction ($F(13, 12849) = 26.3, p = 0.001$). Among individuals without a history of CJS, there was a difference in the number of initial visits based on PTSD status. For those with a history of CJS, there was no difference in the number of visits based on PTSD status. These data suggest that PTSD moderates the relationship between CJS and initial visits (See Figure 8).

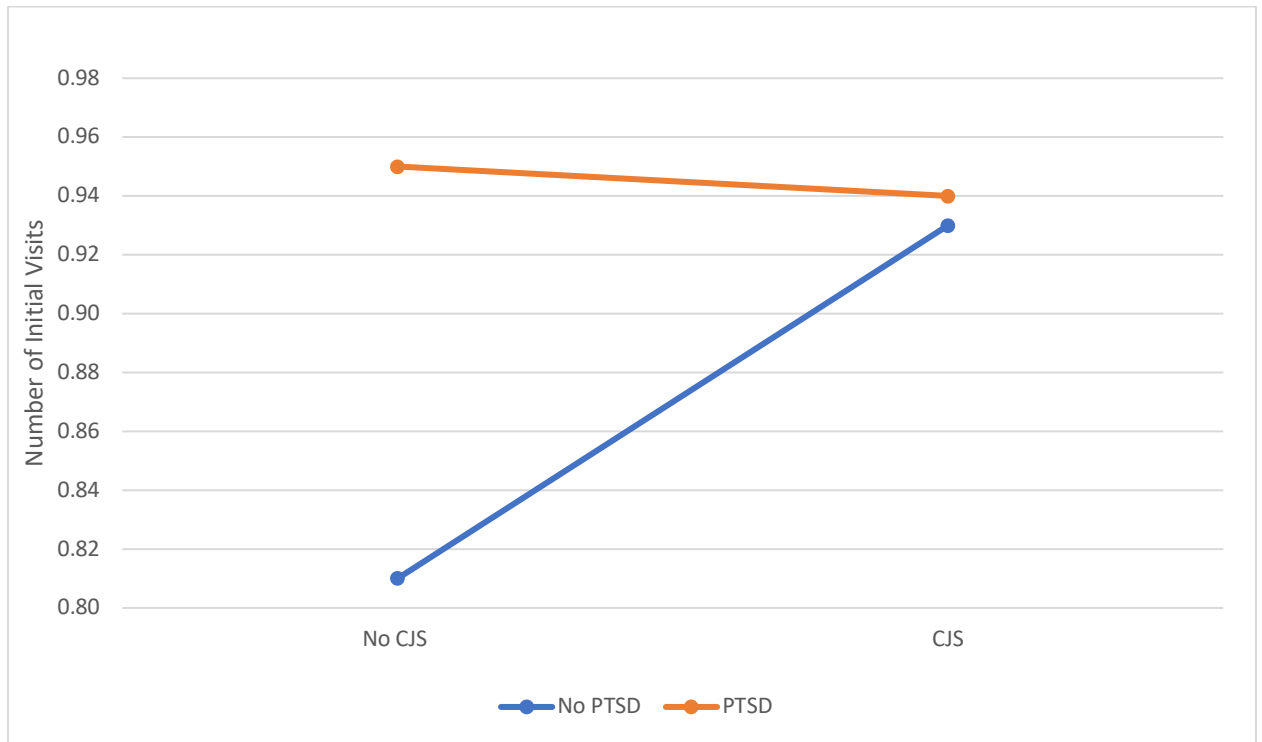


Figure 8. Initial visits by PTSD x CJS interaction.

There was a significant interaction of PTSD X CJS on the number of induction visits ($F(13, 12849) = 16.7, p < 0.001$). Regardless of PTSD history individuals with a history of CJS had more induction visits than those without a history of CJS history. Among those who did not have a history of CJS, patients with PTSD had a higher rate of induction visits than those without PTSD. These data suggest that PTSD moderates the relationship between CJS and induction visits (see Figure 9).

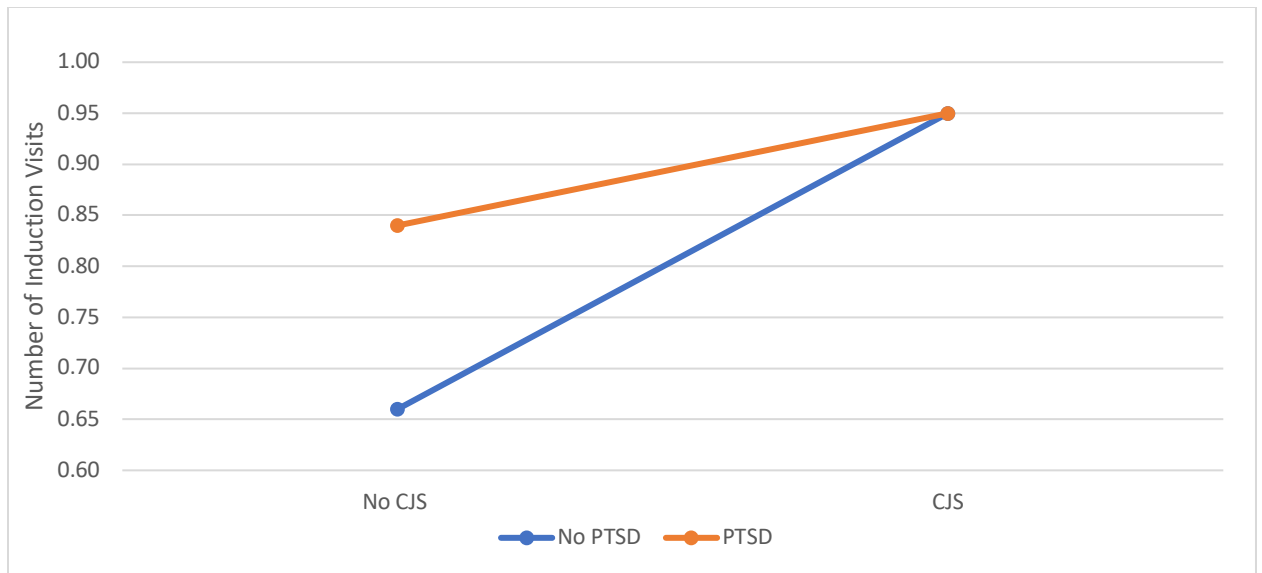


Figure 9. Induction visits by PTSD x CJS interaction.

The relationship between CJS and time since the last visit was different across the different PTSD groups [$F(13, 13365) = 6.4, p = 0.011$]. The difference in time since the last visit was greater between those who had PTSD and those who did not have PTSD among those without a history of CJS. If there was a history of CJS, there was minimal difference in the time since the last visits. These data suggest that PTSD moderates the relationship between CJS and time since last seen (see Figure 10).

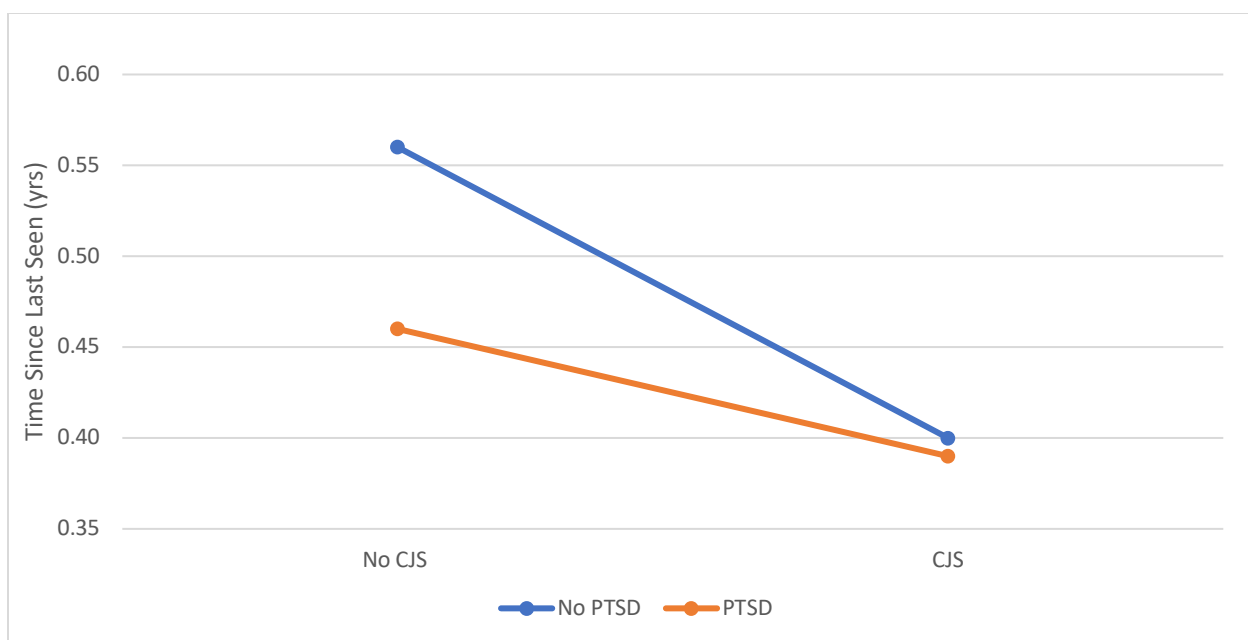


Figure 10. Time since last visit by PTSD x CJS interaction.

Impact of PTSD on the Relationship between CJS and MT/Drug Use

Medication Adherence

When evaluating the main effects of PTSD and CJS on medication adherence and drug use, the majority of the main effects were identical to what was presented in Aims 1 and 2. However, there were a few exceptions: opioids, THC, and other drugs (see Table 20). The impact of CJS on opioid use was statistically significant in prior analyses. In the current analysis, the impact of CJS fell below the threshold for significance ($F(13, 11595) = 3.7, p = 0.056$). In contrast, although the impact of CJS on THC and other drugs was not significant in AIM 2 analyses, in the current analyses, individuals with a history of CJS had less THC use [$F(13, 11595) = 4.2, p = 0.041$] and more other drug use [$F(13, 11595) = 9.3, p = 0.002$]. When examining for the potential of a CJS X PTSD interaction on medication adherence and drug use, the relationship between CJS and medication and opioids use were different across the PTSD levels. There were no significant PTSD X CJS X Gender interactions.

Table 19. Relationship of Medication adherence/Drug Use by PTSD, CJS, and Gender.

Drug (% Positive)	PTSD	CJS	PTSD X CJS	PTSD X Gender X CJS
	F	F	F	F
Buprenorphine	7.2**	13.1***	6.2*	1.2
Benzodiazepine	65.3***	0.2	0.0	1.9
Alcohol	3.3	0.3	0.2	1.2
THC	11.7**	4.2*	0.0	0.1
Amphetamine	10.6**	2.2	0.5	0.2
Cocaine	12.8***	13.7***	0.1	0.2
Methadone	0.0	0.3	2.6	1.0
Other drug	3.8	9.3**	4.8	0.8
Opioids	8.7**	3.7	5.3*	0.0

*p<.05 **p<.01. ***p<.001

There was a significant interaction of PTSD and CJS on the percent positive buprenorphine screens [$F(13, 11595) = 6.2, p = 0.013$]. Among individuals without a history of CJS, those with PTSD had the higher percentage of buprenorphine positive screens than those without PTSD (Figure 11). These data suggest that PTSD moderates the relationship between CJS and medication adherence.

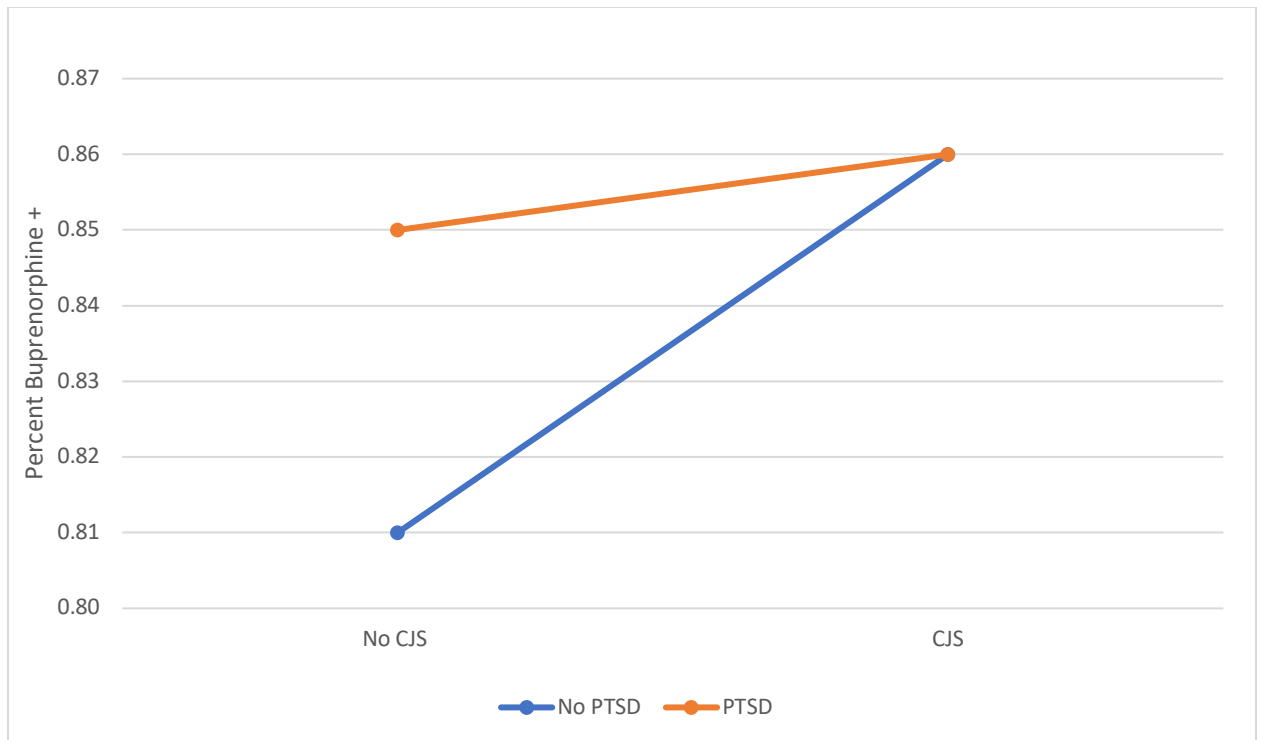


Figure 11. The % positive for buprenorphine among PTSD x CJS interaction.

Drug Use

There was a significant difference in the relationship between CJS and opioid use based on PTSD status [$F(13, 11595) = 5.3, p = 0.021$](Figure 12). There was minimal difference in the percentage of positive opioid screens for those with a CJS history. Among those without a history of CJS, those without PTSD had a higher percentage of positive opioid screens than those without PTSD. These data suggest that PTSD moderates the relationship between CJS and percent positive of opioid screens.

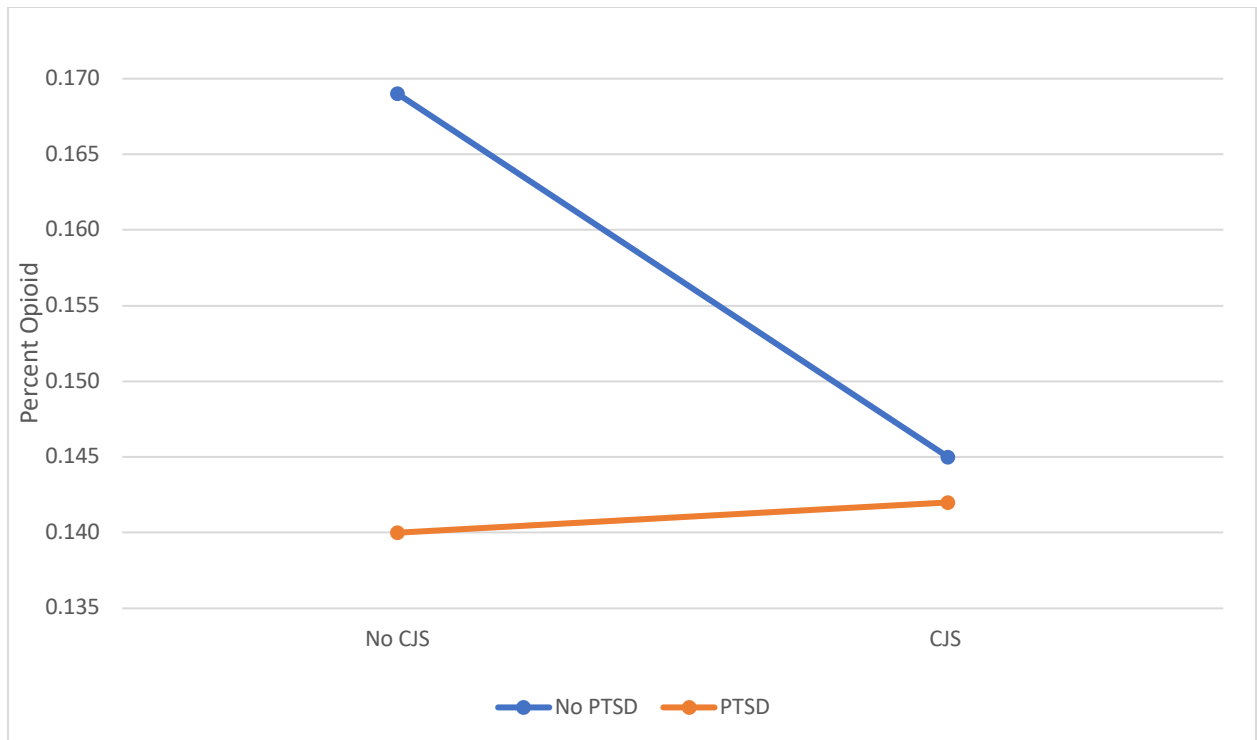


Figure 12. The % positive for opioids by PTSD x CJS interaction.

Aim 5. To examine if trauma status moderates the relationship between involvement in the CJS and Medication Treatment success.

Impact of Trauma on the Relationship between CJS and Treatment Compliance

When evaluating the main effects of trauma and CJS among treatment compliance indicators, most of the main effects were as described in AIMS 1 and 2. The only exception was care interruptions. Although in AIM 1 there was a significant relationship between Trauma and care interruptions, in the current analyses, this relationship was no longer significant ($F(13, 12849) = 2.0, p = .153$)(See Table 21). When examining for CJS X trauma interactions, several were identified: “no show” visits, initial visits, induction visits, group visits, number of encounters, and time since the last visit. There were also several trauma X CJS X gender interactions: “no show” visits, maintenance visits, and the total number of encounters.

Table 20. Relationship of Treatment Compliance by Trauma, CJS, and Gender

Treatment Compliance	Trauma	CJS	Trauma X CJS	Trauma X CJS X Gender
	F	F	F	F
# no show visits	19.2***	277.5***	17.9***	5.3*
# maintenance visits	106.6***	105.6***	0.0	11.0**
# initial visits	7.6**	26.1***	47.0***	0.0
# rejoin visits	36.7***	201.7***	0.3	1.3
# induction visits	61.7***	112.9***	11.6**	2.7
# group visits	0.7	1.8	13.3***	0.0
# no show group visits	1.9	22.1***	2.2	0.2
# group cancellations	1.3	3.6	2.5	0.3
# rescheduled visits	41.5***	81.3***	3.5	0.6
# other encounters	256.5***	371.2***	28.4***	9.1**
Time since last visit (yrs)	163.7***	19.0***	29.3***	0.1
# care interruptions	2.0	88.8***	1.4	0.0
Total time in care (yrs)	314.1***	399.9***	2.4	0.8

*p<.05 **p<.01. ***p<.001

There was a difference in the relationship between CJS and the number of “no show” visits by trauma status ($F(13, 12849) = 17.9, p < 0.001$). Patients with trauma and a history of CJS had a higher rate of ‘no show’ visits than patients without PTSD and a history of CJS (Figure 13). These data suggest that trauma moderates the relationship between CJS and “no show” visits.

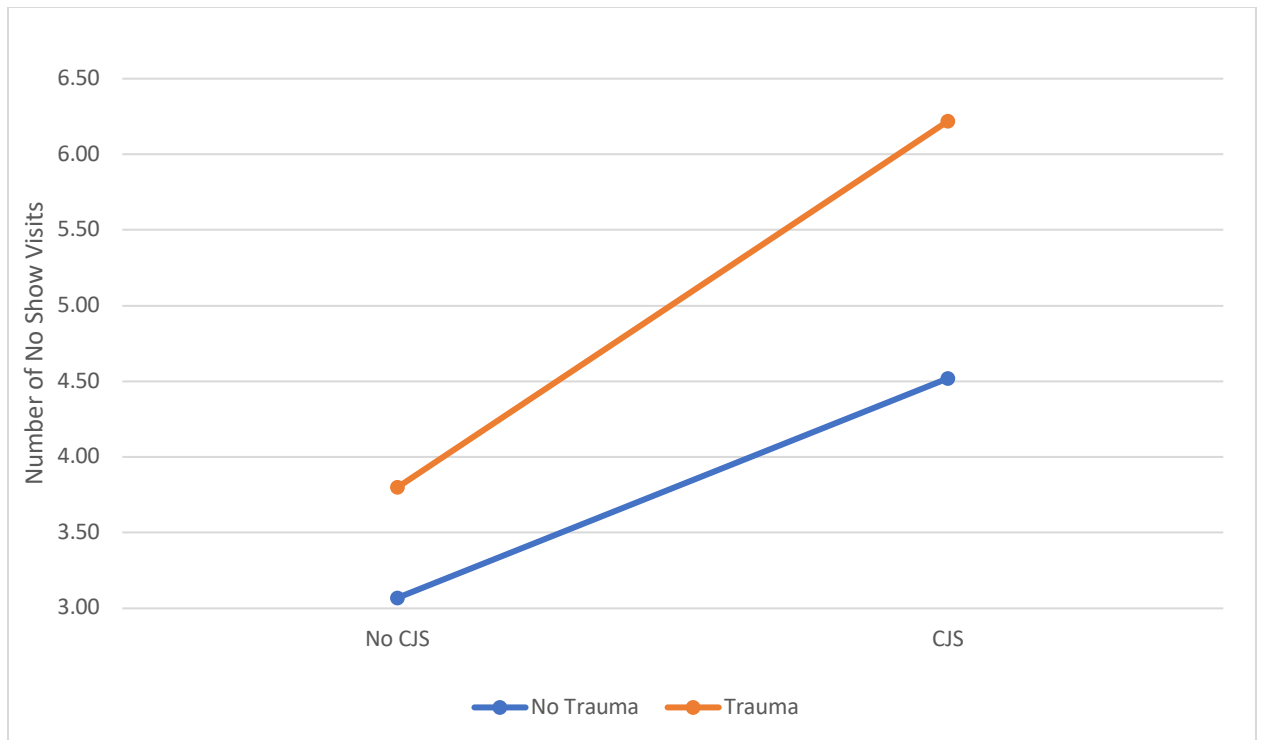


Figure 13. Total # of no show visits within trauma x CJS

Evaluation of the interaction of Trauma and CJS on the number induction visits, identified a significant effect ($F(13, 12849) = 11.6, p < 0.001$). Individuals with CJS had a high rate of encounters regardless of trauma history. In contrast, if there was not a history of involvement with CJS, individual with a trauma history had more induction visits, than those with a trauma history. These data suggest that trauma moderates the relationship between CJS and induction visits (see Figure 14).

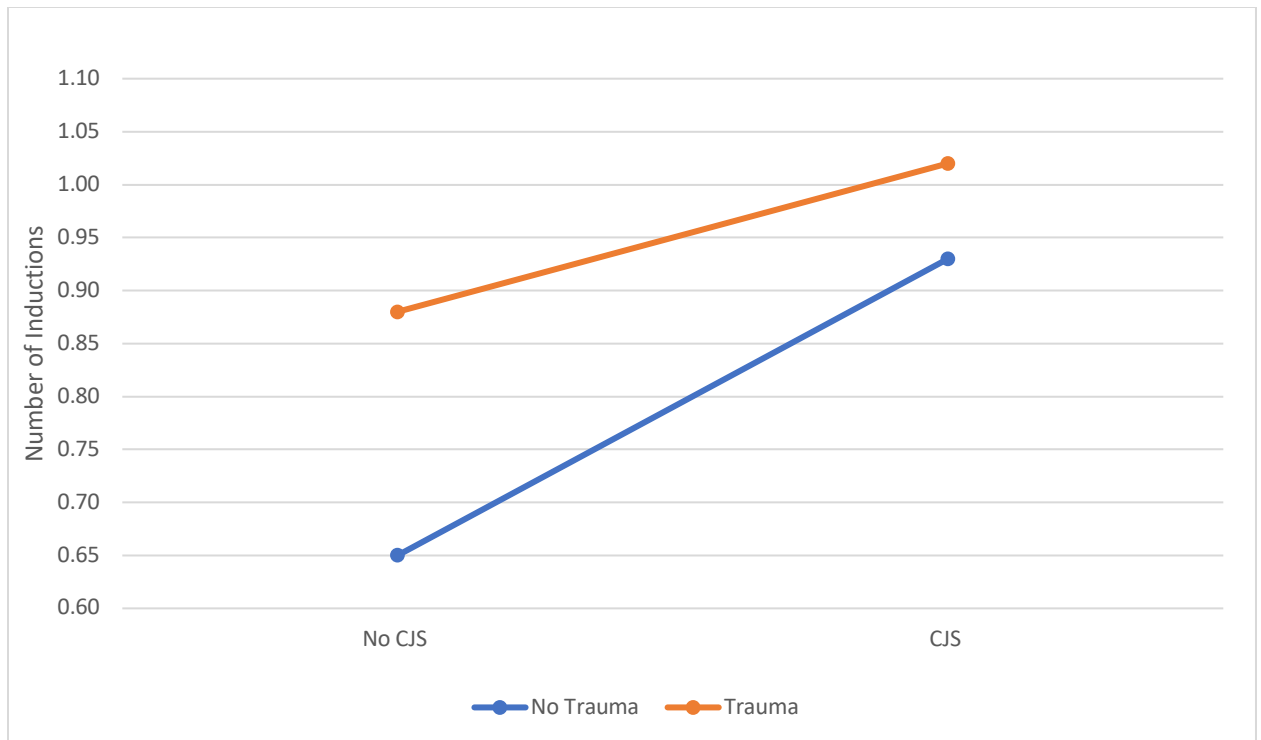


Figure 14. Total # of induction visits within trauma x CJS.

There was also a significant trauma X CJS interaction on the number of encounters ($F(13, 12849) = 28.4, p < 0.001$). The relationship between CJS and the number of encounters was greater for those with a history of trauma than those without a history of trauma. These data suggest that Trauma moderates the relationship between CJS and the number of encounters (see Figure 15).

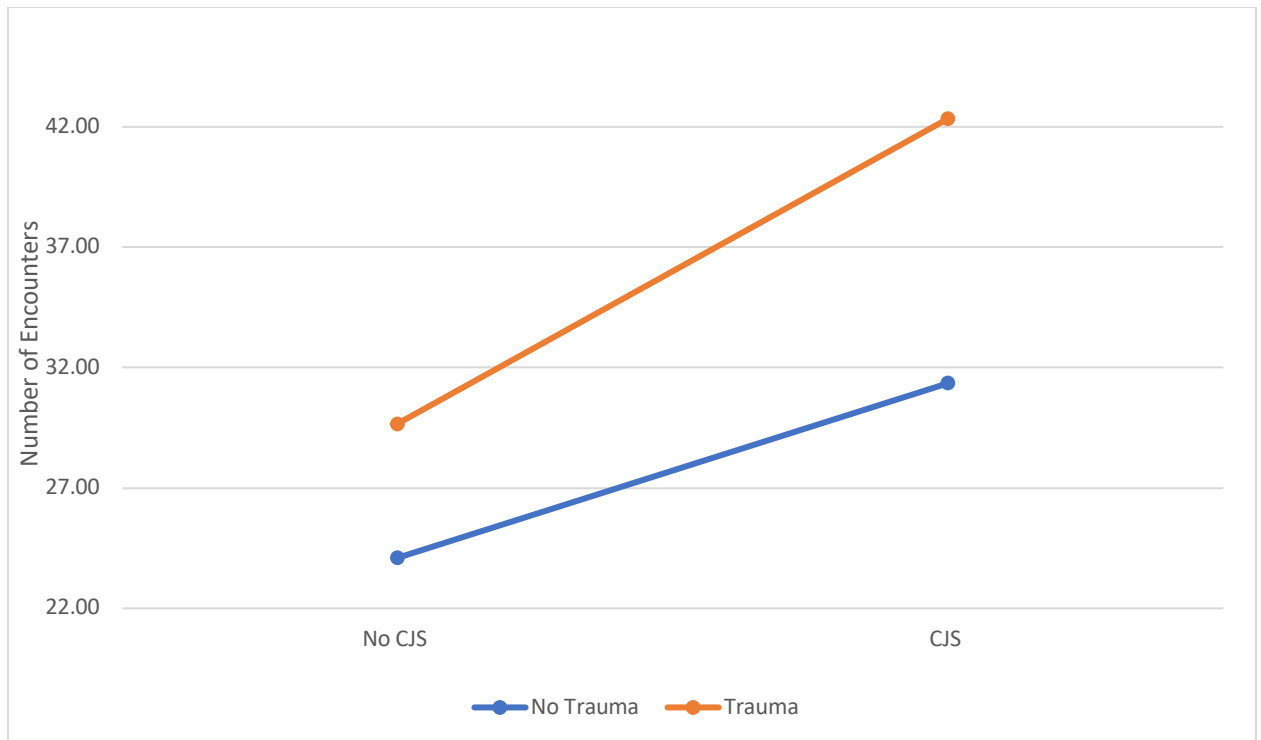


Figure 15. Total # of encounters within trauma x CJS.

There was a difference in the relationship between CJS status and time since last visit ($F(13, 12849) = 29.3, p < 0.001$) based on trauma history group membership. If a patient had a history of trauma, time since a patient was last seen was virtually identical between CJS groups. If a patient had a history of trauma, patients who also had a history of CJS had been seen more recently than individuals without a history of CJS. These data suggest that trauma moderates the relationship between CJS and time since last seen (Figure 16).

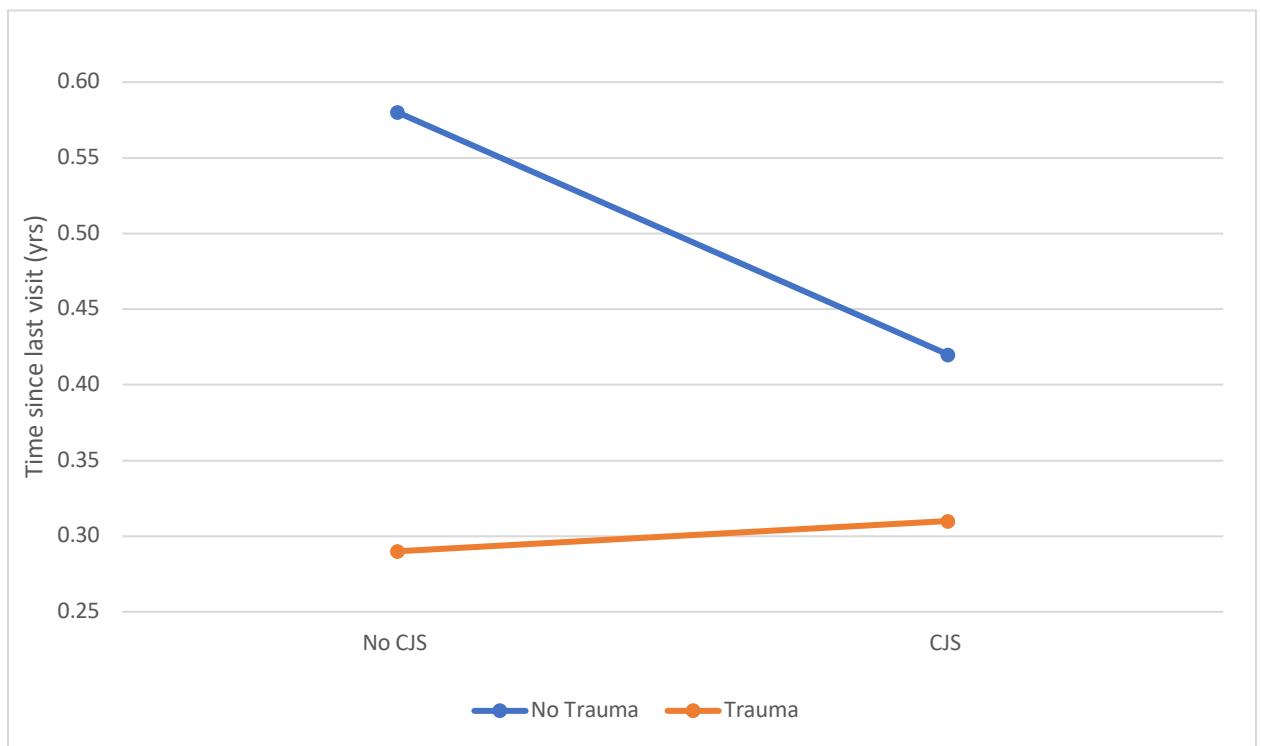


Figure 16. Time since last visit by trauma x CJS interaction.

There was a difference in the relationship between CJS status and initial visit ($F(13, 12849) = 47.0, p < 0.001$) based on trauma history group membership. For those with a trauma history, there is minimal difference in initial visits based on CJS status with those with a CJS status being slightly lower. Among those without a trauma history, those with a history of CJS had more initial visits than patients without a history of CJS. These data suggest that trauma moderates the relationship between CJS and number of initial visits (Figure 17).

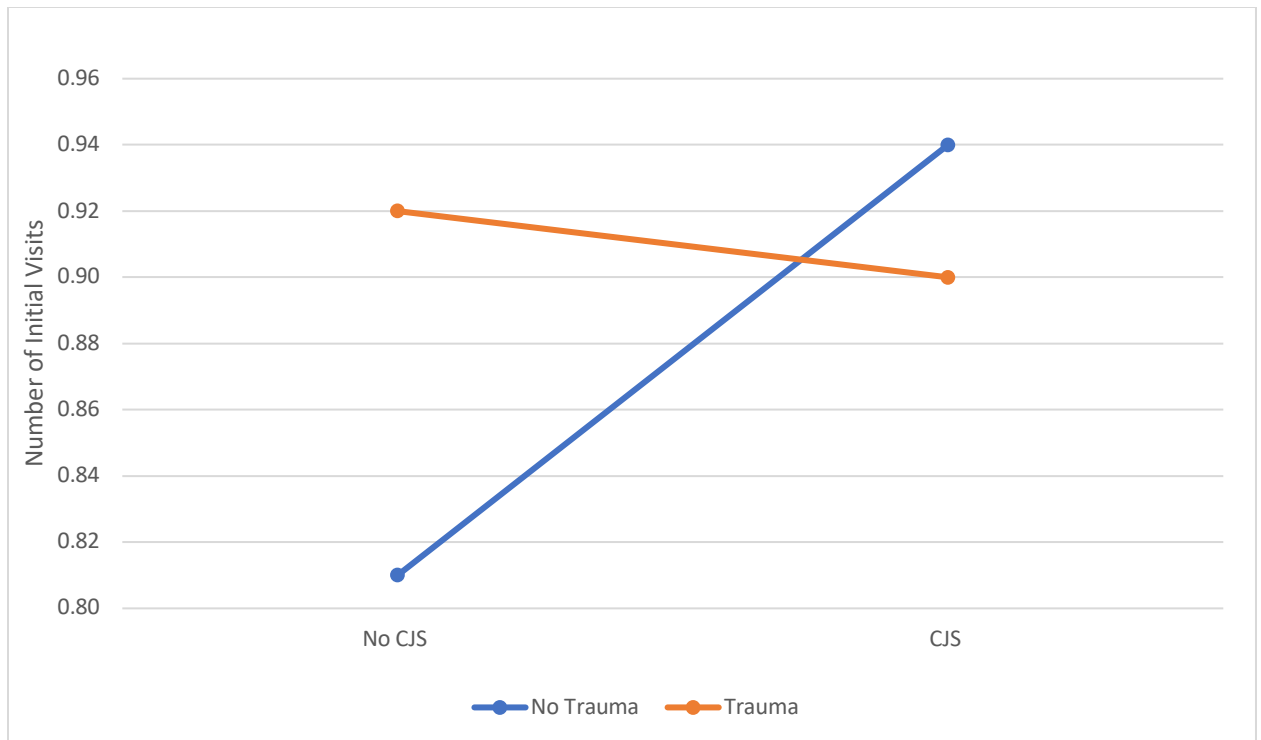


Figure 17. Total # of initial visits by trauma x CJS interaction.

There was a difference in the relationship between CJS status and group visits ($F(13, 12849) = 13.3, p < 0.001$) based on trauma history group membership. For those with a trauma history, there is a difference in group visits based on CJS status with those with a CJS status being lower. Among those without a trauma history, those with a history of CJS had more group visits than patients without a history of CJS. These data suggest that trauma moderates the relationship between CJS and number of group visits (Figure 18).

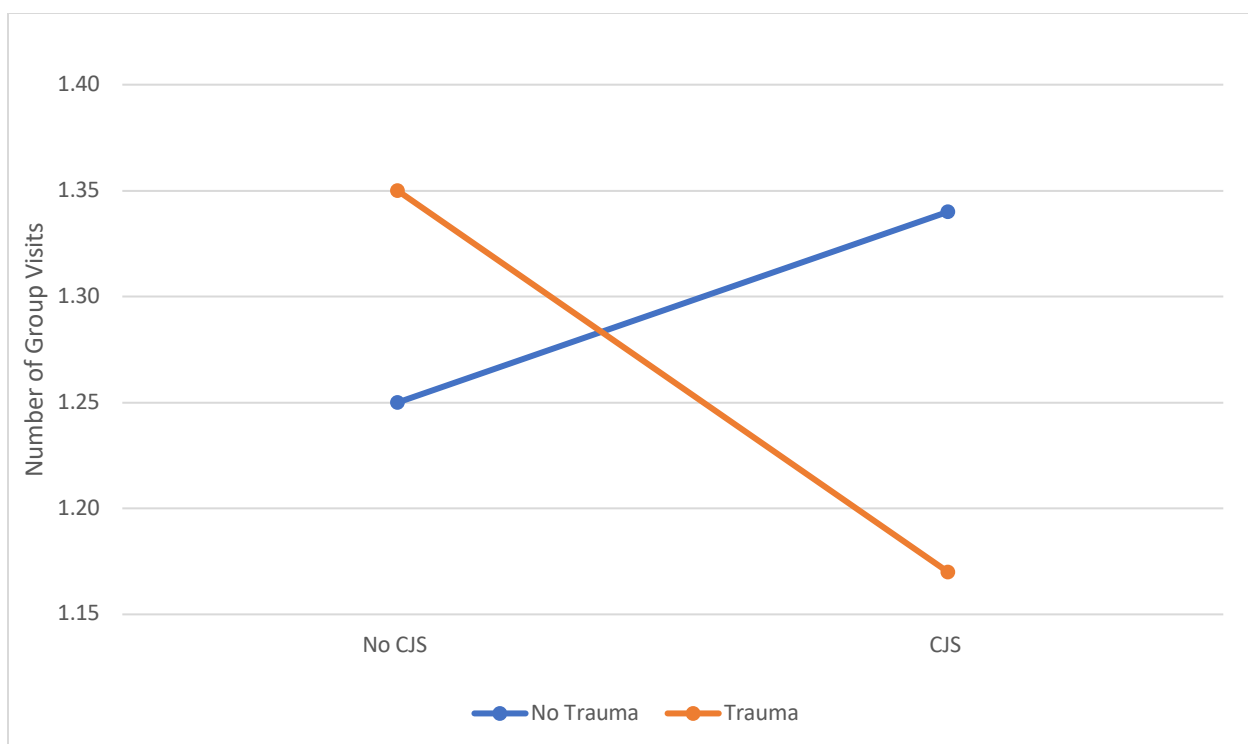


Figure 18. Total # of group visits by trauma x CJS interaction.

Impact of Trauma on the Relationship between CJS and MT Adherence/Drug Use

Medication Adherence

When evaluating the main effects of trauma and CJS among medication adherence and drug use, all of the main effects were as described in AIMS 1 and 2. In addition, there was also a significant trauma X CJS interaction for buprenorphine and opioids (Table 22). There were no significant trauma X CJS X gender interactions.

Table 21. Relationship between Medication adherence/Drug Use by PTSD, CJS, and Gender.

Drug (% Positive)	Trauma	CJS	Trauma*CJS	Trauma*CJS*Gender
	F	F	F	F
Buprenorphine	9.8**	12.1**	15.6***	0.0
Benzodiazepine	22.5***	1.7	1.7	0.1
Alcohol	0.6	0.7	1.7	0.2
THC	2.3	2.9	0.2	0.2
Amphetamine	17.2***	2.1	0.4	0.0
Cocaine	17.2***	24.5***	1.4	1.3
Methadone	0.0	2.4	0.6	0.1
Other drug	2.9	4.4*	0.5	0.0
Opioids All	0.0	4.8*	11.0**	1.5

*p<.05 **p<.01. ***p<.001

As mentioned, there was a significant impact of trauma on the relationship between CJS and medication adherence. Regardless of CJS status, patients with a history of trauma had high rates of medication adherence ($F(13, 11595) = 15.7, p < 0.001$). Among those without a history of trauma, patients without a history of CJS had lower rates of medication adherence than patients without a history of CJS. These data suggest that trauma moderates the relationship between CJS and number of and percent of positive buprenorphine screens (Figure 19).

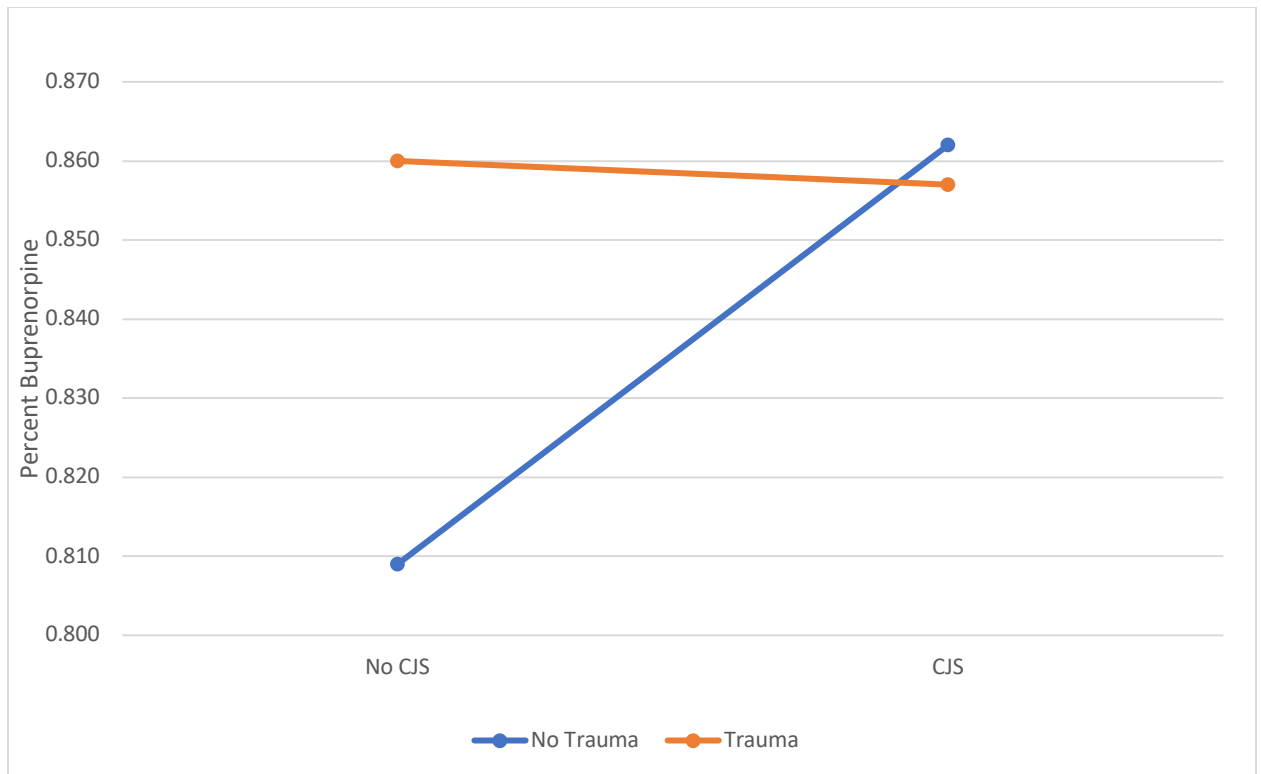


Figure 19. The % positive for buprenorphine within CJS x Trauma interaction.

Drug Use

There is a significant difference between CJS and opioid use based on Trauma status ($F(13, 11595) = 11.0, p = 0.001$). For those with a trauma history, there is minimal difference in opioid use based on CJS status. Among those without a trauma history, those without a history of CJS had more opioid use than patients with a history of CJS. These data suggest that trauma moderates the relationship between CJS and number of encounters (Figure X). These data suggest that trauma moderates the relationship between CJS and number of encounters (Figure 20).

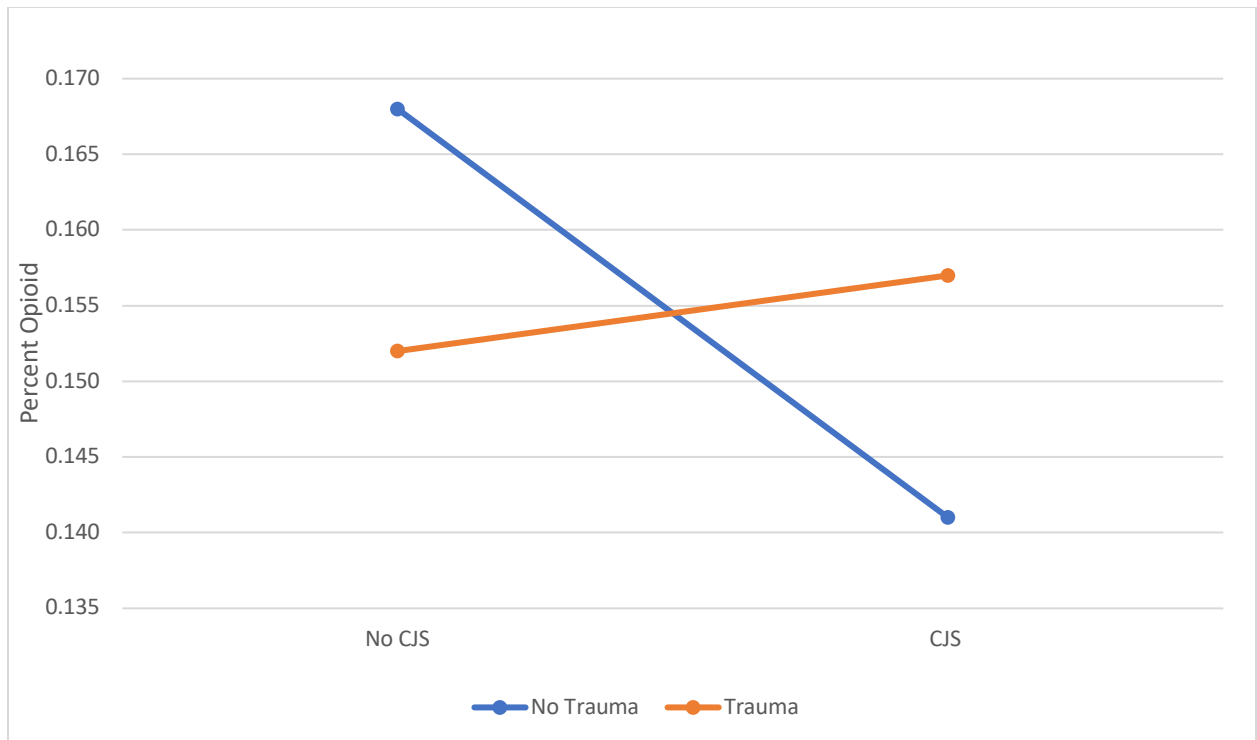


Figure 20. The % positive for opioids by CJS x Trauma interaction.

Influence of Gender on the Relationships between Trauma and CJS and Outcomes

Exploring the influence of gender on the relationships between trauma and CJS on outcomes did not identify many significant interactions. Only the number of “no show” visits and the number of maintenance visits were significant. There was a significant impact of gender on the interaction of trauma and CJS on maintenance visits [$F(13, 12849) = 11.0, p = 0.001$]. When examining the impact on trauma and CJS on the number of maintenance visits for men is different than for women. For men, those with a history of trauma have more maintenance visits regardless of CJS history (Figure 21). For women, the impact of CJS history appears to have more of an impact on the overall number of maintenance visits attended (Figure 22). These data suggest that gender moderates the relationships between trauma, CJS, and maintenance visits.

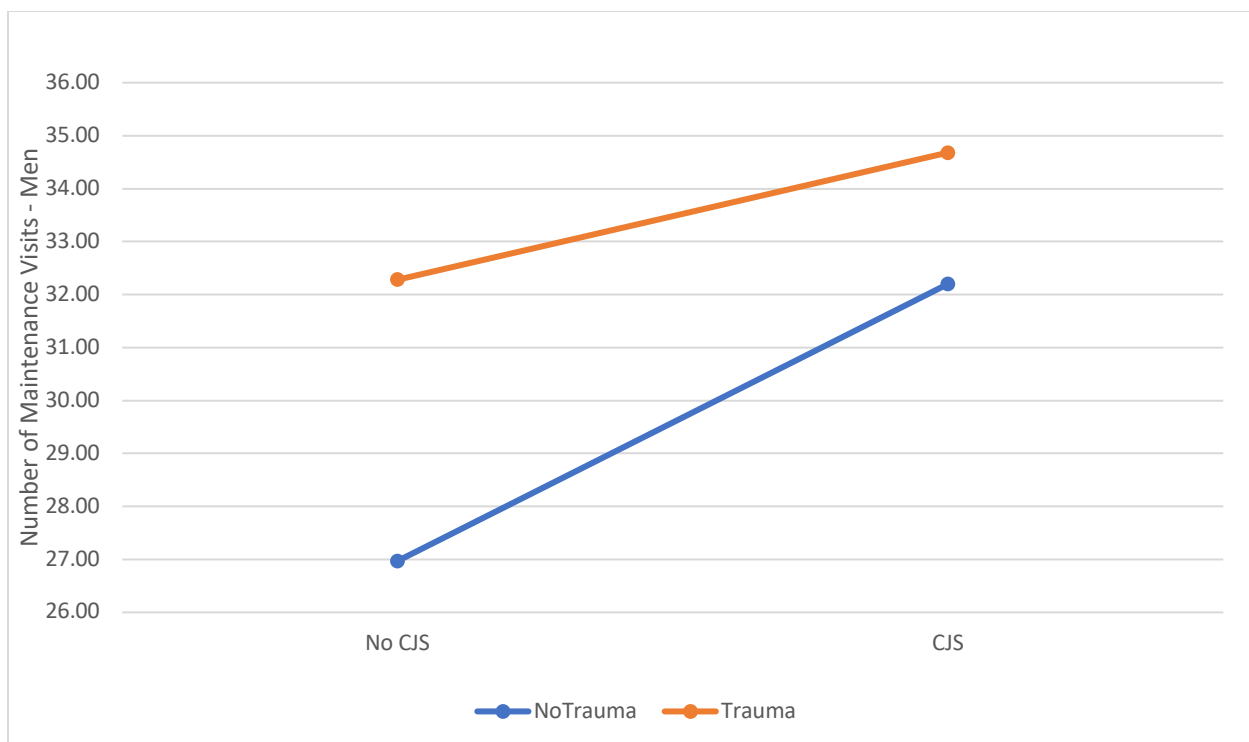


Figure 21. Maintenance visits by CJS and Trauma for Men.

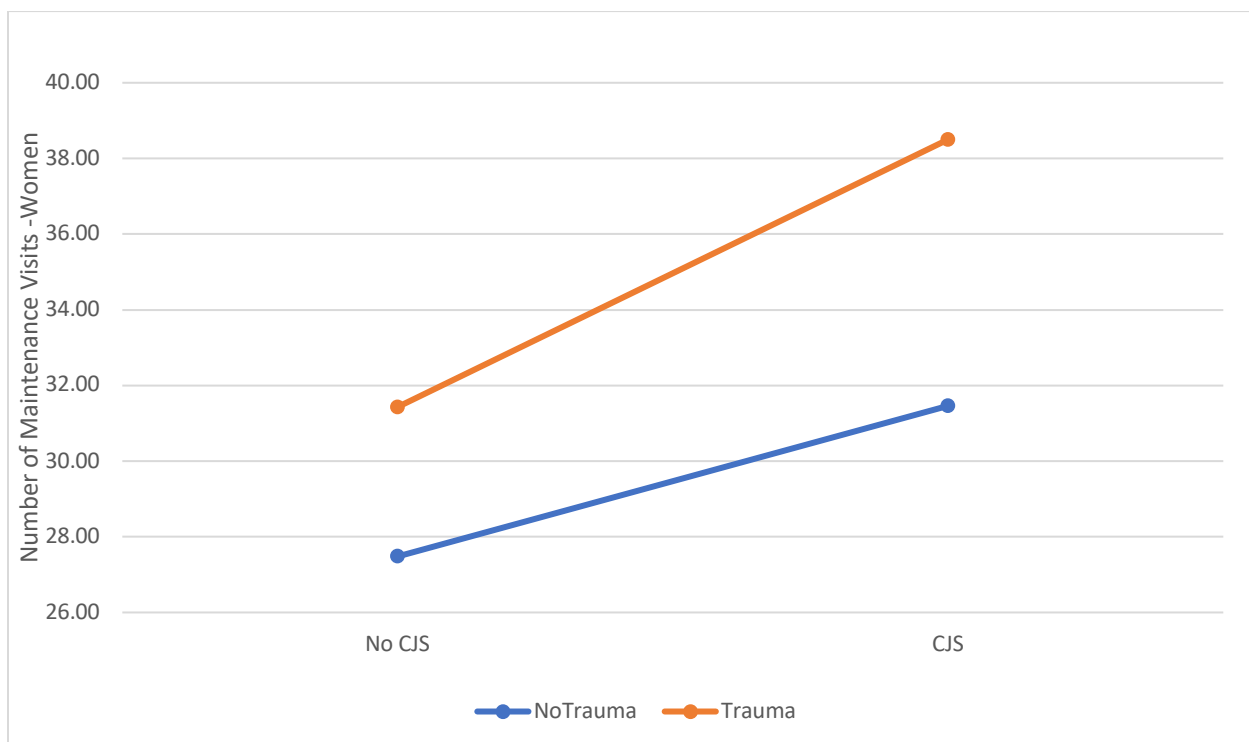


Figure 22. Maintenance visits by CJS and Trauma for Women.

Figure 23 and 24 presents the data for the number of “no show” visits by trauma and CJS history by gender. There was a significant interaction of gender, trauma, and CJS status for the number of “no show” visits ($F(13, 12849) = 5.3, p = 0.021$). There was minimal different in the number of “no show” visits based on trauma history for men. Both trauma groups had more “no show” visits if there was a history of involvement with CJS than if there was no history of CJS. For women, there were minimal differences among those without trauma based on CJS status. If there was a history and CJS and there was also a history of trauma, there was a high rate of “no show” visits. These data suggest that gender moderates the relationships between trauma, CJS, and “no show” visits.

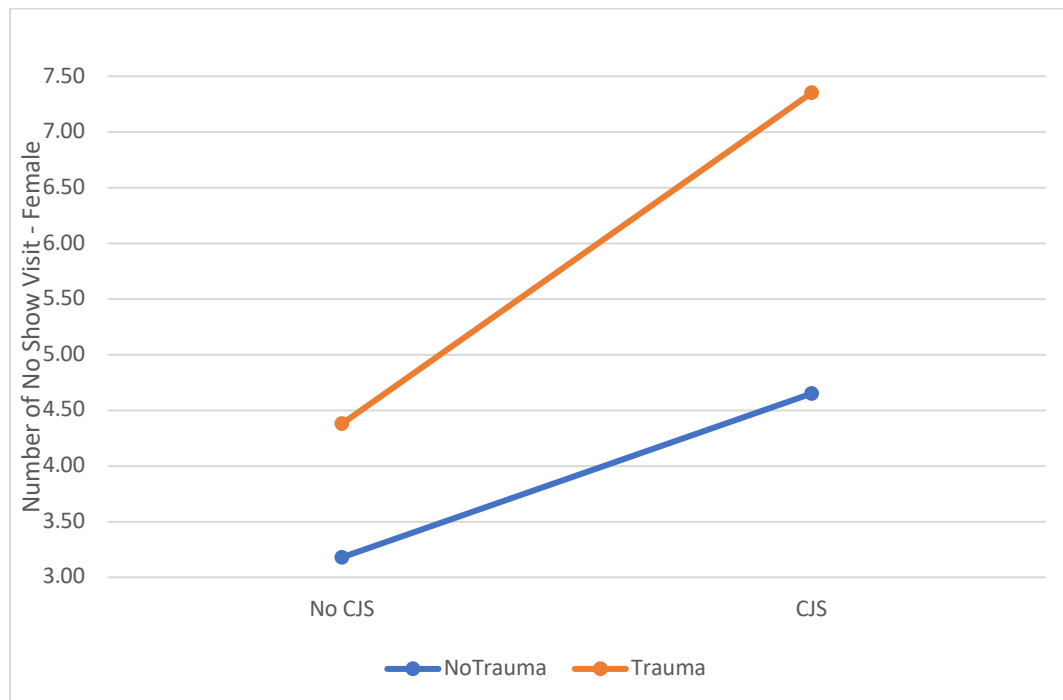


Figure 23. “No show” visits by CJS and Trauma for Women.

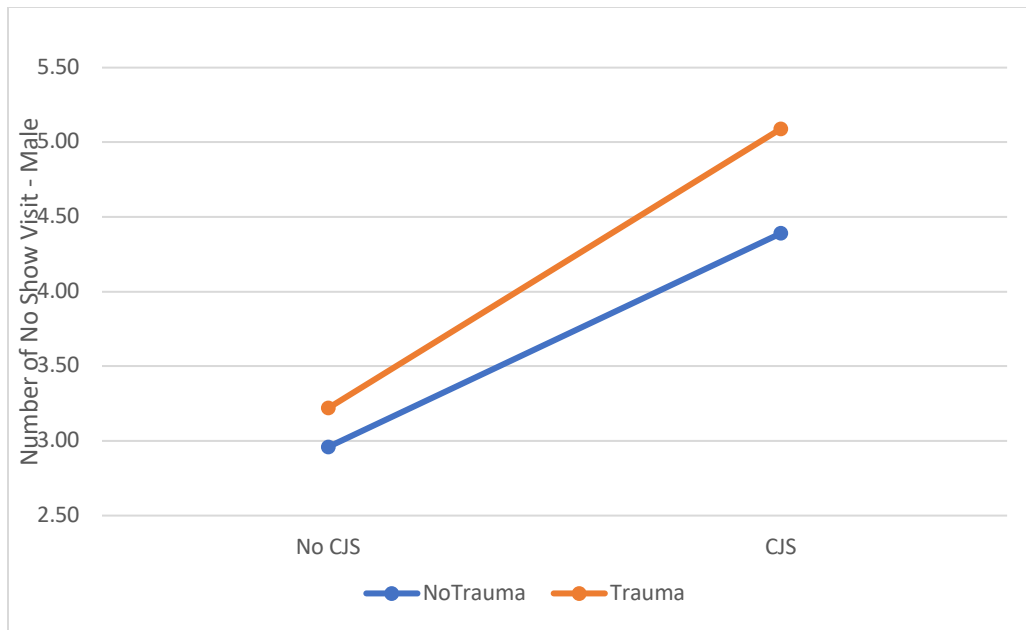


Figure 24. *Figure X.* “No show” visits by CJS and Trauma for Men.

CHAPTER 5

DISCUSSION

This chapter provides a discussion of the findings of the study. This study set out to understand the impact that post-traumatic stress (PTS), trauma, and an involvement in the criminal justice system has on the outcomes of opioid use disorder treatment. This study utilized treatment compliance outcomes, medication adherence outcomes, and drug use as the findings. This study sought to answer three major questions:

1. Do those patients with PTSD have less successful treatment outcomes than those without PTSD?
2. Do those patients with an involvement in the criminal justice system have less successful treatment outcomes than those without an involvement in the criminal justice system?
3. Does PTSD/Trauma moderate the relationship between the having a criminal justice status and treatment outcomes?

Summary of Results

Table 23 provides a summary of the relationships between each of the independent variables (PTSD, trauma, criminal justice status, and gender) among both the treatment/medication adherence indicators and drug use indicators. Table 24 provides a summary of the results from interaction analyses between all treatment compliance indicators and drug use by independent variables by gender and CJS.

Table 22. Summary of relationships by Treatment compliance and Drug Use

Treatment Compliance	PTSD	Trauma	CJS	Gender
# no show visits	+	+	+	+ (W↑)
# initial visits	+	+	+	-
# rejoin visits	+	+	+	-
# induction visits	+	+	+	-
# care interruptions	+	+	+	+ (M↑) (CJS)
# group cancellations	-	-	-	+ (W↑) (CJS)
# rescheduled visits	+	+	+	+ (W↑)
# maintenance visits	+	+	+	-
# other encounters	+	+	+	+ (W↑)
# group visits	-	-	-	-
# no show group visits	-	-	+	+ (W↑) (Trauma/CJS)
Time since last visits (yrs)	+	+	+	+ (M↑) (CJS)
Total time in care (yrs)	+	+	+	+ (W↑)
Medication/Drug Use	PTSD	Trauma	CJS	Gender
Buprenorphine	+	+	+	-
Benzodiazepine	+	+	-	+ (W↑)
THC	+	-	-	+ (M↑)
Amphetamine	+	+	-	+ (W↑) (Trauma/ CJS)
Alcohol	-	-	-	+ (M↑)
Cocaine	+	+	+	-
Opioids All	+	-	-	-
Methadone	-	-	-	-
Other drug	-	-	-	-

+ = a relationship between treatment compliance or drug use and IV's

- = no support of a relationship between DV and IV

Unless otherwise noted, +/- apply to all PTSD, Trauma, and CJS groups

M = men, W = women,

↑ = highest #/percent

Table 23. Summary of interactions by Treatment/ compliance and Drug Use

Treatment Compliance	PTSD x CJS	Trauma x CJS	PTSD x Gender	Trauma x Gender	CJS x Gender	PTSD x Gender x CJS	Trauma x Gender x CJS
# no show visits	-	+	-	+ (W↑)	+ (W↑)	-	+ (M↑ w/CJS) (W↑ w/CJS)
# initial visits	+	-	-	-	-	-	-
# rejoin visits	-	-	-	-	-	-	-
# induction visits	+	+	-	-	-	-	-
# care interruptions	-	-	-	-	-	-	-
# group cancellations	-	-	-	-	-	-	-
# rescheduled visits	-	-	-	+ (W↑)	-	-	-
# maintenance visits	-	-	-	-	-	-	+ (M↑/Trauma) (W↑ w/CJS)
# other encounters	-	+	-	+ (W↑)	+ (W↑)	-	+ (M↑ w/CJS) (W↑ w/CJS)
# group visits	-	-	-	-	-	-	-
# no show group visits	-	-	-	-	-	-	-
Time since last visits (yrs)	-	+	-	-	-	-	-
Total time in care (yrs)	-	-	-	-	-	-	-
Medication/Drug Use	PTSD x CJS	Trauma x CJS	PTSD x Gender	Trauma x Gender	CJS x Gender	PTSD x Gender X CJS	Trauma x Gender X CJS
Buprenorphine	+	+	-	-	-	-	-
Benzodiazepine	-	-	-	-	-	-	-
THC	-	-	-	-	-	-	-
Amphetamine	-	-	-	-	-	-	-
Alcohol	-	-	-	-	-	-	-
Cocaine	-	-	-	-	-	-	-
Opioids All	+	+	-	-	-	-	-
Methadone	-	-	-	-	-	-	-
Other drug	+	-	-	-	-	-	-

+ = a relationship between treatment compliance or drug use and IV's

- = no support of a relationship between DV and IV

Unless otherwise noted, +/- apply to all PTSD, Trauma, and CJS groups

M = men, W = women, ↑ = highest #/percent

The Impact of PTSD on Treatment Compliance

Patients with a positive PTSD status were not as successful in meeting treatment compliance indicators as those without PTSD. It was hypothesized that those patients with PTSD would have a lower rate of attending scheduled individual and group visits. Furthermore, it was thought that these patients would not attend meetings without notifying center staff, that they would reschedule and cancel group visits more often, have more encounters with staff, leave care more often and need more initial, inductions, and rejoin visits. Those patients with an increase in PTSD symptoms did reveal less treatment compliance throughout many treatment indicators and increased drug use. It was hypothesized that those patients with PTSD would have a lower rate of adherence to buprenorphine and an increase in other drug use, especially opioid use. There is more than adequate evidence demonstrating that buprenorphine treatment contributes to higher retention in treatment, lower opioid use, lower other substance use, and lower mortality (D'Onofrio et al., 2017; Mattick, Breen, Kimber, & Davoli, 2014; Parks Thomas et al., 2014). Yet, despite this evidence, these findings are not evident when considering evidence of PTSD or a history of trauma. Patients within this study with PTSD are more buprenorphine adherent than those without PTSD yet are also having higher percentages of opioid and other substance use and failing to meet treatment compliance indicators highlights the major issue these patients are struggling to stay med compliant and their immediate needs are not being met.

Patients with PTSD did not appear for scheduled individual visits more frequently than those without PTSD. It has been noted previously that treatment for co-occurring SUD/PTSD has the potential for high drop-out rates and a reduction in treatment due to the stress of reliving traumatic events (Gielen, Krumeich, Havermans, Smeets, & Jansen,

2014; Kehle-Forbes et al., 2016). The differences in practitioner's ability to effectively counsel based on an integrated therapy for both SUD/PTSD may also contribute to some patients feeling not fully supported (Killeen, Back, & Brady, 2015) and thus not attend scheduled individual meetings. Surprisingly, there were no differences noted with regards to any of the group visit indicators. The number of group visits cancellations, the amount of 'no show' visits, and the number of group visits overall did not significantly differ from those without PTSD. This may be that those feel more supported by peer-oriented groups. There is the additional motivation for patients to remain compliant with group visits as this is required for them to be prescribed MT by clinicians.

Unexpectedly, those with PTSD attended more maintenance visits than those without PTSD. This may be attributed again to either a higher gestalt rating from the provider and needing a greater degree of follow-up as well as a desired coping mechanism to continue medication treatment. Though their results are based on a considerably smaller sample size than this study, this outcome is contrary to Norman, Tate, Wilkins, Cummins, & Brown (2010). They determined that there were no differences between those with and without PTSD and their attendance at maintenance visits.

It was expected that those patients with PTSD would have a shorter time since last seen and have a longer duration in care. It was found that these patients have a shorter time since last seen. Since patients are having more encounters with staff, their time between visits should be shorter and indicative of increased risk for relapse. It is possible that the clinical staff (advance practice nurses and physicians) placed them on a higher level of intervention which would result in more frequent visitation. One can view this as

potentially beneficial for them as it does allow them the opportunity to seek help and interact with staff more frequently.

The patient's total time in care increases with PTSD. As this is cumulative time in treatment, when accounting for the fact that those with PTSD have an increased number of initial visits, rejoins, inductions, interruptions, and reschedules, this has the potential to add a significant amount of time to their overall treatment. The significant need for long term treatment for those with co-occurring PTSD and OUD has been noted by Mills et al. (2018) at 11-years follow-up, 46% of their similar cohort was still in treatment for their SUD.

It was hypothesized that those patients with PTSD would have a lower rate of adherence to buprenorphine and an increase in other drug use, especially opioid use. There is more than adequate evidence demonstrating that buprenorphine treatment contributes to higher retention in treatment, lower opioid use, lower other substance use, and lower mortality (D'Onofrio et al., 2017; Parks Thomas et al., 2014). Yet, despite this evidence, these findings are not evident when considering evidence of PTSD or a history of trauma. The fact that those patients with PTSD in this study are more buprenorphine adherent than those without PTSD yet are also having higher percentages of opioid and other substance use, and meeting treatment compliance indicators highlights the major issue these patients are struggling to stay med compliant and their immediate needs are not being met. As their PTSD and trauma history are influencing their feelings of safety, possible loss of control, heightened anxiety levels, etc., they may not be fully ready to commit to full treatment compliance (US Department of Health and Human Services, 2014).

PTSD and Buprenorphine

Surprisingly, patients with PTSD were more adherent to their prescribed buprenorphine regimen than those without PTSD. Past research has shown that those with PTSD have had decreased adherence to buprenorphine (Kumari et al., 2016). This could be related to their increased number of encounters and shorter time since last seen. As they are seen more frequently by staff, the motivation to continue their medication treatment increases. As this is the philosophy of this particular treatment center, this is validation that increasing visits and contact with staff when risk is elevated, has the benefit of increased medication adherence. This is supported by previous work by Schacht, Brooner, King, Kidorf, & Peirce (2017) who found that the longer their participants stayed in treatment they reduced their positive urine screens for drugs and had less severe symptoms for those with PTSD. Similarly, Meshberg-Cohen, Black, DeViva, Petrakis, & Rosen (2019) determined that those veterans in treatment for PTSD/OD treatment that received concurrent therapy for trauma while receiving buprenorphine, resulted in an increased length of retention in their program with overall greater treatment success as a result.

PTSD and Drug Use

Those with PTSD did have a higher rate of opioid use than those without PTSD. These results suggest that while those patients with PTSD were still motivated to maintain their buprenorphine adherence, they still struggled to refrain from opioid use. As discussed in chapter 2, those patients with PTSD typically have a higher rate of opioid use than those without PTSD (Meier et al., 2014). This outcome is contrary to previous findings by Mills et al. (2018) that found at follow-up to treatment no baseline difference in heroin use based on PTSD status.

While this study used an amalgam of opioids as one indicator, which included prescription and non-prescription opioids, Meier et al. (2014) had similar findings in their study based on prescription opioids and the severity of other substance use among those with PTSD while in treatment. In contrast to previous findings by Kumari et al. (2016), those with PTSD having used opioids during treatment also had a lower compliance with buprenorphine.

Impact of Trauma on Treatment Compliance

Similar to the PTSD group, those patients with a history of trauma did show less treatment compliance throughout the same treatment indicators as well as increased drug use same as the PTSD group. Those patients with a history of trauma had a lower rate of attending scheduled individual and group visits. Consequently, they also did not attend meetings without notifying center staff, they rescheduled and cancelled group visits more often, had more encounters with staff, left care more often and needed more initial, induction, and rejoin visits. As mentioned earlier as regards PTSD, the same is valid for patients with trauma histories. Although they are staying more medication adherent with buprenorphine than those without trauma histories, they are also using opioids and other substances more, and missing the same treatment compliance indicators as those with PTSD. This group is similarly struggling to stay within the program of medication adherence and treatment compliance.

Similar to those patients with PTSD, those with a history of trauma, had the exact same treatment compliance results in terms of significant relationships between trauma and treatment indicators. Based on prior research, it is assumed that many of those with a trauma history in this study are also underdiagnosed as having PTSD (Elhai et al., 2012; Zimmerman & Mattia, 1999). This may provide the explanation as to why these two

groups had the same results. If in fact those with trauma also had undiagnosed PTSD, They may be experiencing similar symptoms and their specific needs in respect to needing trauma-informed care are simply not being met with just buprenorphine treatment.

Impact of Trauma on Medication Adherence and Drug Use

Trauma and Buprenorphine

Similar to the PTSD group, those with a history of trauma they were in fact more adherent to their scheduled medication than those without a history of trauma. While it was hypothesized that those with a history of trauma would also not be adherent to their buprenorphine, similar to the PTSD group, the reasons for this result are the same for the PTSD group. Since those with a history of trauma were also less treatment compliant in terms of visits, they would have had more interaction with staff and would have been more focused and motivated to stay adherent to their medication schedule knowing they would be seen more frequently by treatment center staff.

Trauma and Drug Use

While those with a history of trauma had similar drug use as those with PTSD, there were two differences. Those with a history of trauma did not have a significant relationship to opioids and THC. Reasons for this may be that while this group has experienced a traumatic event, they may not have developed a post-traumatic response and as a necessity tried to reduce symptoms associated with the sequelae of trauma. It has been discussed in other studies that those affected in a traumatic way will at times use opioids and THC more as a means to self-medicate to try to reduce symptoms of anxiety related to trauma (Hassan, Foll, Imtiaz, & Rehm, 2017; Meshberg-Cohen et al., 2019; Saunders et al., 2015). This may not be the case for this particular group of patients.

The Impact of CJS on Treatment Compliance

Those patients with CJS displayed less treatment compliance throughout the same treatment indicators as well as increased drug use similar to the PTSD/trauma groups. This was an expected outcome. As was discussed in chapter 2, those with an involvement in the criminal justice system often suffer from PTSD and experience trauma during their incarceration experience. Additionally, those with CJS are also at a higher risk to enter incarceration having already experienced trauma and/or having a diagnosis of PTSD (Anderson, Geier, & Cahill, 2016; Harner, Budescu, Gillihan, Riley, & Foa, 2015; Kouyoumdjian et al., 2015). Similar to the PTSD/trauma groups, it was hypothesized that those patients with CJS would have a lower rate of attending scheduled individual and group visits.

Similar to those patients with PTSD/Trauma, those with CJS, had the exact same treatment compliance results in terms of significant relationships between CJS and treatment indicators. One difference from the other two predictors was the addition of a significant relationship between CJS and no shows for group visits. Upon further evaluation, even when controlling for age, race, time since last seen, total time in care, location, and ethnicity, there was no evidence of moderation between PTSD or trauma on CJS and group no shows. A possible explanation for this difference may be that some people with criminal justice involvement that are in treatment SUD find it hard to share in group therapy situations and may prefer individualized treatment (Owens, Chen, Simpson, Timko, & Williams, 2018).

The inclusion of an interaction term also revealed a moderating effect of PTSD on CJS with regards to initial and induction visits. It was not apparent in the literature that this relationship was examined previously. One potential explanation is that again as

patients with CJS are also managing their PTSD symptoms, it may be that the PTSD itself is having an effect on their ability to stay focused in treatment and thus leaving with more frequency and having to have additional initial and induction visits similar to that of main effects relationship of PTSD to treatment compliance.

Impact of CJS on Medication Adherence and Drug Use

CJS and Buprenorphine

Unexpectedly, those with CJS were more adherent with their buprenorphine regimen. It was hypothesized that again, the CJS group, like that of the PTSD/trauma groups would not be as adherent to their buprenorphine as the non-CJS group. This may be due to a motivation to stay free of drugs and committed to their treatment due to the consequences of having to return to incarceration if they are found to be drug positive. As those with CJS increased the total time in care, there is also a significant decrease in opioid use. This finding is consistent with Gordon et al. (2015) and research on parolees and probationers who were in medication treatment for OUD.

CJS and Drug Use

Another unexpected result was that the CJS group had less drug use than expected compared to the non-CJS group especially as it pertains to opioids and methadone. The CJS group had significantly less percentage of opioids and methadone than the non-CJS group. This again suggests that not only is there a motivation to stay free from incarceration, but potentially the preference for more may be protective from drug use. This finding supports observations by Fox et al. (2015) who conducted a small number of interviews with patients who had previously been incarcerated and were either presently in treatment for OUD or had been in the past. They found that these patients preferred

medication treatment over abstinence-based recovery. Furthermore, they not only preferred medication treatment, but also favored buprenorphine over methadone.

CJS was evaluated with PTSD and trauma as potential moderates and found that both PTSD and trauma moderated that effect that CJS had on increasing buprenorphine adherence and a slightly higher use of opioids over the non-PTSD and non-trauma groups. As mentioned previously, these results mirror the PTSD and trauma main effects. The most interesting of these results is that of the moderation effect on opioids. While those with PTSD but without CJS are using opioids significantly less than the non-PTSD group as in the main effect, once CJS is added, there is a significant reduction in use of opioids for the non-PTSD group which is concurrent with the previous evaluation of CJS main effects, but the PTSD group slightly increases their opioid use. This again shows that even with the motivation of staying free of opioids in the CJS group, this isn't enough to override the need to still use opioids once PTSD is added. This is additionally another measure that needs to be accounted for during and before release from incarceration. If this group had been evaluated for both OUD and PTSD and trauma at the same time on admission and treated appropriately, we may see that the CJS with PTSD group stays at the same level of opioid use.

Impact of Gender on Treatment Compliance

When evaluating treatment compliance by gender, there were noted differences between men and women. Women, similar to those with PTSD and histories of trauma, are being underserved within this treatment modality. Again, while there was no difference in medication adherence, there were still more instance of failed treatment compliance, and other drug use. As noted previously, women had the highest percentages of PTSD and trauma, which may contribute to some of these issues.

Gender was combined with trauma to evaluate moderating effects and found that trauma did moderate the effects of no-show visits, rescheduling, and more encounters, with women always having higher rates than men. A similar interaction was evaluated for CJS and gender and found that the effects of CJS on gender. With many people within CJS groups experiencing trauma before and during incarceration, this could be the reason for the same effect. It is still apparent that women are struggling as well and need more directed care with a focus on trauma specific treatment.

There were noted differences in gender as a predictor than the other three predictors (PTSD, trauma, and CJS). There were no gender differences in the attendance to maintenance visits, which is similar to findings by McHugh et al. (2013) that found no gender differences in attendance at treatment sessions. Women spent more time in care than men which is supported from previous research (Evans et al., 2015). Women were more likely to have more no shows, no show group visits, cancel group meetings in the CJS group, and reschedule visits more. One explanation for this may simply be social functioning of women compared to men. A study of gender differences in OUD treatment by Bawor et al. (2015) revealed that while women were less likely to be employed than men, they were three times as likely to be caring for children. Another explanation could be that as 13.4% women had a PTSD status and 17.0% of women had a trauma history, there may be a reluctance to attend both individual and group treatment sessions for fear of stigma, anxiety, or embarrassment. However, this may not overtly affect their ability to maintain the same use of buprenorphine and use of opioids as men. As Sokol, LaVertu, Morrill, Albanese, & Schuman-Olivier (2018) pointed out after a large systematic review of studies based on group therapy based treatments for OUD

patients, there does not appear to be a large-scale significance for outcomes based on group therapy for those with OUD.

Impact of Gender on Medication Adherence and Drug Use

Evaluating medication adherence and drug use by gender revealed differences between gender and the three other predictor variables.

Gender and Medication Adherence

The relationship between gender and buprenorphine adherence was not significant.

Gender and Drug Use

Women showed an increased use of benzodiazepines and amphetamines (among trauma and CJS groups) which is consistent with previous findings (Bawor et al., 2015). The use of amphetamines is particularly alarming as research by Evans et al. (2015) revealed the concurrent use of amphetamines and opioids contributes to an increase in the hazard risk for death for women that are in treatment for OUD.

Men had a significant increased use of THC and alcohol. Bawor et al. (2015) also determined that THC use was higher in men, however, they did not determine any gender differences for alcohol. This present study found alcohol to be higher by positive urine screen in men.

Application to Theory

As previously noted in chapter 2, Lazarus and Folkman's (Lazarus & Folkman, 1984) *Transactional Stress* theory informed the study by providing a framework to view stress, appraising stress, and coping with stress as a goal focused toward long-term adaptation to stress. These stress indicators were not measured, but rather assumed under the operationalized variables of PTSD, trauma, and CJS. The initial reason for choosing

this theory was based on the prevalence within the literature suggesting that a large proportion of those with an OUD were using opioids and other substances as a way to reduce stress or in response to stress from trauma. The transactional stress theory appeared to fit well within the realm of opioid use while managing PTSD, a history of trauma, a past incarceration experience, or the presence of all three. As discussed in the literature review, all three of these situations has the ability to create a larger stress dynamic for the patient through an increase in anxiety and other psychosomatic responses to stress. Lazarus and Folkman regard the ideal coping method as a series of appraisals followed by conscious decision making to react in an adaptive way.

The chronic brain disease model of addiction suggests that those with OUD using opioids and other substance continue to disrupt decision-making and self-control neural processes within the brain (Baler & Volkow, 2006; NIDA, 2018). This disruption makes it more difficult to make pertinent decisions related to controlling one's use of substances in relation to events in their life (Smith, Mattick, Jamadar, & Iredale, 2014; Volkow & Morales, 2015). This is similar to the transactional stress theory that theorizes a stress response to a specific event in life. As hypothesized in Chapter 2, for those with PTSD, CJS, or trauma, a successful coping strategy would be for those patients to employ a problem-based method to solve their stressful situation. The optimal end result would be free of drug use as a consequence that benefits not only short-term gains but can cumulatively function as building a long-term physical and cognitive response to stress without opioids or other drug use.

The transactional stress theory is complementary to the chronic disease model as viewed through this study. Framing the study through transactional stress theory, it suggests that potentially, the patient's brain is learning to sustain itself with markedly less

opioids with the use of buprenorphine, the patient is also making repeated appraisals which neurobiologically is redefining neural connections to learn to cope more effectively without opioids (Volkow, Koob, & McLellan, 2016). Within this study though, for those with PTSD and trauma, as an example, we can view two responses to stress. The increase in maintenance visits for those with PTSD and trauma, than those without, could be viewed as evidence that when combined with medication treatment (MT) there is an adaptive coping strategy being employed in light of the stress, which will hopefully lead to long-term adaptation. However, there is also the increase of use of opioids for those with PTSD and trauma than those without. This is reflective of poor decision making as a result of assumed stress and maladaptive coping strategies utilized by patients with PTSD, trauma, and a CJS.

In regard to treatment compliance, all three predictor variables have similar significance and direction in terms of compliance indicators. For those three predictor groups, missing maintenance visits without notice, leaving treatment and then rejoining and having to have more initial and induction visits, are all consequences of appraisals based on stress and control. Those visits present several possibilities of stress for the patients that begins the process as a causal antecedent. Failing to meet those compliance indicators could be because the person is worried about having to provide a urine sample knowing it will produce positive results for drug use.

An explanation for this is that those patients are anxious about attending an individual session with a provider and having to talk or re-live a traumatic experience. There could be an element of shame and stigma that is holding a patient back from attending these visits. These are results of false or negative appraisals that allow the patient to revert back to place of wanting to maintain control for fear of harm or trauma.

As these patients miss more meetings and need to induct themselves to treatment, we can view their subsequent attendance as a positive appraisal that have resulted in their ability to attend these visits and to be safe and unharmed.

Those patients with PTSD/trauma/CJS showed maladaptive coping skills in their use of opioids, THC, cocaine, benzodiazepines, and amphetamines. It is clear that upon primary appraisals of stress during their treatment they have still reverted back to using opioids or other drugs. However, they are still maintaining adherence to their buprenorphine treatment more than those without PTSD/trauma/CJS, which over time may allow these groups of patients to benefit from long-term effects of continuing treatment with buprenorphine, while reducing their use of opiates and other drugs. This has the potential benefit of long-lasting recovery, improved mental health, reduced mortality, improved social functioning through long-term adaption to life stressors.

One particular example of Lazarus and Folkman's concept of problem-focused coping is the success of the CJS group to use opioids less than those without CJS and have a higher rate of buprenorphine use. Re-entering their communities after incarceration increases stress and risk for relapse (Binswanger et al., 2012; Wakeman, 2017). When encountering stress in their lives, these individuals appear to be attending to the situation from a problem-focused position. This process may include cognitively appraising the consequences of using opioids again and not adhering to their medication treatment, which may result in their return to incarceration (Matusow et al., 2013). This increased vigilance may offer the patient the needed focus to problem solve effectively, which is enhanced due to the addition of medication treatment which will also reduce cravings and additional reduction of symptoms from reduced opiate use.

This raises more questions if looking at transactional stress within the realm of a chronic brain disease model for addiction for those CJS patients. If this is a lack of adaptive coping, self-control, and inappropriate decision making, how is it that those within the CJS group are able to override that and not rely on opioids? Applying this theory to CJS patients in this manner supposes the implication of psychological stress on those patients when in fact those may be simply weighing a cost-benefit analysis of staying opioid free to stay out of jail or prison. Theories and concepts of motivation, control, community risk factors, or punitive justice/treatment policies warrants further study especially in light of the findings of this study.

Implications for Nursing Practice

As this study has confirmed, those with PTSD, a history of trauma, and a past involvement in the criminal justice system, can have very significant and lasting consequences that impact treatment compliance and medication adherence for those with OUD. The Substance Abuse and Mental Health Services Administration (SAMHSA) states that it is imperative that treating trauma should be a primary goal when treating a person with co-occurring OUD/PTSD or history of trauma (US Department of Health and Human Services, 2014). Advance practice nurses and physicians in various practices are not accepting enough patients even when they have not met their designated capacity to take on patients utilizing buprenorphine (Huhn & Dunn, 2017). Presently, there is a need for nurses and nurse practitioners to care for those with OUD and co-occurring mental health disorders. The American Association of Nurse Practitioners (AANP) educates Nurse Practitioners on the practices of prescribing MT to patients and lowering the risk of overuse of opioids for patients. The education outline on their website is titled: Opioid Risk Evaluation and Mitigation Strategy Resources (REMS). Of concern is

that this lacks any mention of assessing for trauma, PTSD, or past experiences that may involve trauma such as a criminal justice history, veteran, or refugee status as potential risks (AANP, 2018).

If nurse practitioners and nurses are to be trained to successfully to treat those with an OUD, they need to assimilate a model of trauma-informed care for their patients and not only assess prior opioid use, but past trauma. This omission of treating those with trauma is not only absent here but also with the American Society of Addiction Medicine (ASAM). In the published clinical guidelines of practice for the ASAM, the only mention of trauma or PTSD is in relation to assessing for other co-morbid diagnoses during the history and physical (American Society of Addiction Medicine, 2015). While this is a positive step, the manual lacks any mention of what the clinician, nurse, or team member should do if the patient screens positive for these and how to then develop a course of treatment that reflects these potential risks to reduced treatment compliance.

Nurses are poised to be at the forefront of addiction treatment, especially as it relates to those with OUD that also have a history of trauma. As Moller & McLoughlin (2013) assert, the fundamental core nursing philosophy is congruent with that of trauma-informed care. Moller & McLoughlin (2013) remind us that the American Nurses Association (ANA) definition of nursing practice is:

Nursing is the protection, promotion, and optimization of health and abilities, prevention of illness and injury, alleviation of suffering through the diagnosis and treatment of human response, and advocacy in the care of individuals, families, communities, and populations. (American Nurses Association, as cited in Moller & McLoughlin, 2013)

This definition also reflects the key tenets of SAMHSA's framework for trauma-informed care which include safety, trustworthiness and transparency, peer support, collaboration and mutuality, empowerment, voice, cultural, gender issues (US Department of Health and Human Services, 2014). Nurses have the ability to not only fulfill this framework set forth by SAMHSA, but also have the ability to advocate that all clinicians and personnel working within addiction treatment work from a trauma-informed care perspective.

While there are numerous modalities to choose from, nurses have the ability to work from a perspective of trauma-informed care. Working from a trauma-informed care perspective means that a clinician understands how pervasive trauma exists in our patients and communities, grasps the affect that trauma has on people, groups, various societal systems, and takes this understanding and utilizes it to deliver care to the people that are affected by trauma (US Department of Health and Human Services, 2014). Viewing OUD as chronic disease, facilitates nurses' ability to assist patients within a trauma-informed care model. Furthermore, nurses are within a position to provide the long-term, sustained care that these patients need.

One example of a model where nurses can be pivotal members of the treatment team was developed in Massachusetts over the past 10-years in the Office-Based Opioid Treatment -collaborative model (OBOT-B) utilizing buprenorphine (LaBelle, Han, Bergeron, & Samet, 2016). This model is led with a nurse care manager assigned to each patient that provides assessment, induction, education, drug/alcohol assessment, follow-up maintenance visits, and general counsel throughout their treatment program. This is followed under the direction of a physician; however, the model recognizes that nurses are better positioned to spend more time with the patient, have less of a case-load than the

physician, and as mentioned earlier, have a philosophical grounding that allows them to attend holistically to the patient. While this program is an exemplar, it still lacks a focused assessment and further con-current treatment of OUD and trauma with a trauma-informed care model.

No matter the model of choice, at the very least, it should include both nurses and nurse practitioners working in tandem with other clinicians and team members that function from a trauma-informed care perspective. This means that first and foremost as nurses proceed into addiction medicine, they learn as much about the antecedents of trauma and the sequelae from trauma as possible. These nurses should be relied on to assess all patients universally for a history of trauma, and then make the determination whether the patient needs a specific trauma informed approach.

If possible, keeping that same nurse/patient relationship would be essential for developing a sense of belonging, trustworthiness, and safety. As the patient progresses, it will be of great importance for the nurse to praise the patient when meeting all treatment compliance indicators and be yet very empathetic and empowering when the patient may have missed a compliance indicator or had another drug appear on a urine screen for instance. By doing this the nurse will allow the patient to make mistakes, yet still feel empowered to resume treatment.

Limitations to the Study

Data Mining

One limitation is related to the utilization of data mining procedures. Had the electronic health record (EHR) been designed in a manner to easily gather data, this may have given the study the ability to derive a more robust analysis of the data. For instance, finding clinician input of PTSD and trauma symptoms resulted from pulling data from

multiple locations in the EHR. If there was a formalized place to score patients as they were assessed, there may have been an even greater number of patients identified with PTSD or trauma histories as this is an often underdiagnosed group to begin with (Elhai et al., 2012; Zimmerman & Mattia, 1999).

Motivation

An additional limitation is the inability to understand the motivation for treatment success for CJS patients. Those CJS patients may have been involved in a drug treatment court (DTG) or simply had an understanding that if found to having been using opioids, they would be in violation of a probation or parole status. The motivation to avoid reincarceration is plausible but cannot be known as a result of this study. If this was their motivation, this is concurrent with current literature that demonstrates that recidivism of those in DTC's has been shown to decrease for those with increased supervision, MAT, and therapy (DeFulio et al., 2013; Jewell, Rose, Bush, & Bartz, 2017; Sevigny, Fuleihan, & Ferdik, 2013; Shannon, Jones, Newell, & Neal, 2018). It should be noted that the recidivism measured in these previous studies, with the exception of DeFulio et al. (2013), is not based on opioid or drug use at follow-up, it is based on withdrawal from a DTC program, reincarceration, or criminal offense. Following up for long-term periods, even past probation or DTC enrollment, would help provide useful data to determine if opioid use stays low after those initial motivations i.e. not returning to jail or prison, have expired.

Pre-release Medication Treatment

A final CJS-related limitation is the inability to know if participants with CJS had initiation to buprenorphine pre-release from incarceration. While the instances of receiving buprenorphine pre-release from incarceration are limited, it is possible that

some CJS patients may have received medication treatment pre-release. Gordon et al. (2017) found that at 12-months post-release, those patients who had received buprenorphine pre-release displayed increased buprenorphine use and longer time in treatment. Due to this finding, it would be beneficial to know if some of those in the CJS group received buprenorphine pre-release and therefore increased their treatment success in this study.

As previous research has demonstrated that the longer the period of abstinence from opioids (except buprenorphine or methadone), at least 5-years, the greater chance patients have of long-term abstinence (Hser, Evans, Grella, Ling, & Anglin, 2015; Zhu et al., 2018). Evaluating these patients for only a two year period may have limited the ability to view long-term recovery.

Sample Characteristics

In regard to the sample, though a relatively large sample size was used, a limiting factor was the homogenous makeup related to a mostly white, non-Hispanic, mostly from Massachusetts sample. Additionally, it was not known from the sample data whether the patients in the sample were managing an OUD from heroin or prescription opiates. Black and Hispanic patients with an OUD are disproportionately suffering from an addiction to heroin and not prescription opioids (Krawczyk, Feder, Fingerhood, & Saloner, 2017). Earlier studies demonstrated that those in poverty, people of color, Hispanic ethnicity, without a college education, and having an addiction to heroin were more likely to receive methadone than buprenorphine (Hansen et al., 2013; Hatcher, Mendoza, & Hansen, 2018). Recent studies have shown an increase in healthcare utilization for those with an OUD both nationally after the implementation of the Affordable Care Act (McKenna, 2017) and within Massachusetts after implementing a universal care model.

However, despite these increases, black and Hispanic patients are still underserved in terms of receiving buprenorphine treatment for OUD (Krawczyk et al., 2017).

Questions for Future Research

The findings suggest further study focused on whether the motivation for CJS patients to be med adherent and less reliant on opioids is not being reincarcerated. This may prove helpful to understand this motivation as we see an increase in the use of drug courts and provide further evidence to those who would have us only treat those patients with abstinence-based treatments and further incarceration. Further theoretical models should be examined and adapted to direct evidence-based practice regarding CJS patients.

As mentioned earlier, knowing whether or not CJS patients have received buprenorphine during incarceration would help provide further credence that this population needs to be treated while incarcerated not only immediately before re-entry but at the beginning of the incarceration experience.

Finally, it would be important to understand the impact of PTSD treatment on the impact of MT treatment on patients with PTSD. Future research should examine both of these constructs simultaneously. Understanding the individual and group counselor's theoretical approach may help elucidate if patients with PTSD have better MT outcomes with or without specific PTSD treatment. It would also be beneficial to understand if there is an impact of PTSD treatment type as this could help direct care for other patients with similar circumstances.

Conclusions and Implications

This study confirms that those with PTSD, trauma, or a CJS are at increased risk for not only missing and withdrawing from treatment but are requiring far more attention from treatment center staff to manage their recovery. The particular system of patient management that this particular treatment center utilizes appears to have a successful model that is improving the health of their patients, even those with PTSD, trauma, or CJS. Those with PTSD/trauma/CJS are continuing to be medication adherent while at the same time still using other drugs and missing treatment visits. This suggests that these groups are struggling to continue their treatment despite accessing additional help from staff. Additionally, women are a seeming to have the same issues in terms of treatment compliance and need further study to direct care that is supportive to this specific group of patients. The development of interventions specifically focused on PTSD/trauma and CJS experiences would help mitigate this disruption in care.

APPENDIX A

CLEAN SLATE LETTERS OF SUPPORT



May 6th, 2018

Dear Kirk,

As CEO of the CleanSlate Research and Education Foundation, it is my pleasure to support you in your efforts toward the completion of your dissertation. I understand that Dr. Lisa Chiodo, the Director of Research for CleanSlate will be providing you with de-identified data for you to use to meet the aims of your proposal. The Foundation is proud to support student efforts to expand the broad knowledge base providing evidence for interventions with addiction patients that prove efficacy. This great undertaking is very much in line with the mission of the Foundation.

Please do not hesitate to reach out to me if I can be of assistance during this process.

Kindest regards,

A handwritten signature in black ink, appearing to read "A. Wilson".

Amanda Wilson MD

Founder and CEO of CleanSlate Research and Education Foundation
Founder and Chairwoman of the Board of CleanSlate Addiction Treatment Centers
Diplomate, American Board of Addiction Medicine



Kirk Sanger
PhD Candidate
University of Massachusetts

May 5th, 2018

RE: Letter of Support for Data

Dear Kirk,

This letter acknowledges that as Director of Research at CleanSlate Addiction Treatment Centers (CS), I am agreeing to provide the necessary data that will allow you to examine the study aims and hypothesis defined in your dissertation proposal. It is important that you understand that you will receive a de-identified data set and that you are only able to use the data set to answer the questions identified in your dissertation without additional consent.

This data transfer was vetted by the Vice Chancellor of Research at UMASS, Amherst. UMASS approved you receiving the data without obtaining a conflicts management plan. This information was forwarded to you in an e-mail by Jennifer Donais, MPA, CRA, on October 29, 2017. In her letter she indicated that she "presented the circumstances and analysis to the VCRE, who has confirmed for me that we can move forward with the students' access to CleanSlate data without a conflicts management plan."

Once you have successfully defended your proposal and have obtained IRB approval, I will provide you the data set on an encrypted external drive. The data must stay on this drive. It is important that you do not save the data on the UMASS network.

Thank you,

A handwritten signature in black ink, appearing to read "Lisa Chiodo".

Lisa Chiodo, PhD
Director of Research, CleanSlate Addiction Treatment Centers
Board Member, CleanSlate Research and Education Foundation
Associate Professor, University of Massachusetts

APPENDIX B

OPIOID DIAGNOSTIC CRITERIA

1. Opioids are often taken in larger amounts or over a longer period than was intended.
2. There is a persistent desire with unsuccessful effort to cut down or control opioid use.
3. A great deal of time is spent in activities necessary to obtain the opioid, use the opioid, or recover from its effects.
4. Craving, or a strong desire or urge to use opioids.
5. Recurrent opioid use resulting in a failure to fulfill major role obligations at work, school, or home.
6. Continued opioid use despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of opioids.
7. Important social, occupational, or recreational activities are given up or reduced because of opioid use.
8. Recurrent opioid use in situations in which it is physically hazardous.
9. Continued opioid use despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the substance.
10. Tolerance as defined by the following:
 - a. A need for markedly increased amounts of opioids to achieve intoxication or desired effect.
 - b. A markedly diminished effect with continued use of the same amount of an opioid.
11. Withdrawal as manifested by the following:
 - a. The characteristic opioid withdrawal syndrome.
 - b. Opioids (or a closely related substance) are taken to relieve or avoid withdrawal syndrome.

(Diagnostic and statistical manual of mental disorders : DSM-5. (APA, 2013).

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